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ECONOMIC ANALYSIS OF EFFLUENT GUIDELINES
TEXTILES INDUSTRY

Arthur D. Little, Incorporated

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Environmental Protection Agency

June 1975

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OF
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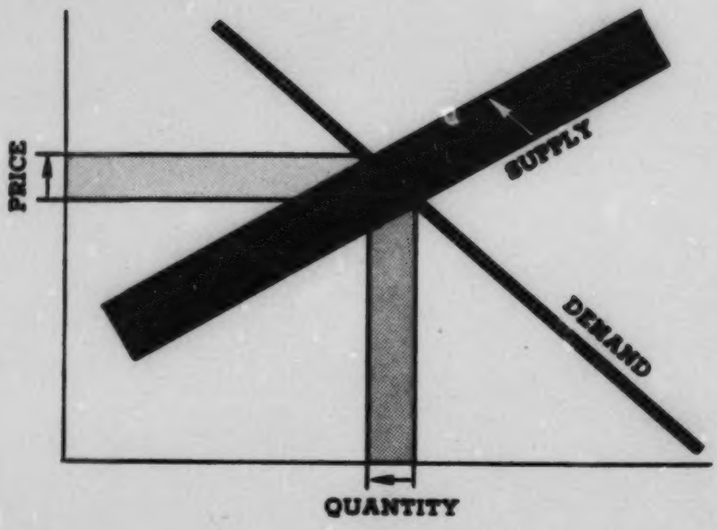

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Office of Planning and Evaluation
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PREFACE

The attached document is a contractor's study prepared for the Office of Planning and Evaluation of the Environmental Protection Agency ("EPA"). The purpose of the study is to analyze the economic impact which could result from the application of alternative effluent limitation guidelines and standards of performance to be established under sections 304(b) and 306 of the Federal Water Pollution Control Act, as amended.

The study supplements the technical study ("EPA Development Document") supporting the issuance of proposed regulations under sections 304(b) and 306. The Development Document surveys existing and potential waste treatment control methods and technology within particular industrial source categories and supports promulgation of certain effluent limitation guidelines and standards of performance based upon an analysis of the feasibility of these guidelines and standards in accordance with the requirements of sections 304(b) and 306 of the Act. Presented in the Development Document are the investment and operating costs associated with various alternative control and treatment technologies. The document supplements this analysis by estimating the broader economic effects which might result from the required application of various control methods and technologies. This study investigates the effect of alternative approaches in terms of product price increases, effects upon employment and the continued viability of affected plants, effects upon foreign trade, and other competitive effects.

The study has been prepared with the supervision and review of the Office of Planning and Evaluation of EPA. This report was submitted in fulfillment of Contract No. 68-01-1541, Task Order No. 37 by Arthur D. Little, Inc. Work was completed as of June 1975.

This report represents the conclusions of the contractor. It has been reviewed by the Office of Planning and Evaluation and approved for publication. Approval does not signify that the contents necessarily reflect the views of the Environmental Protection Agency. The study has been considered, together with the Development Document, information received in the form of public comments on the proposed regulations, and other materials, in the establishment of final effluent limitation guidelines and standards of performance.

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1. ECONOMIC ANALYSIS SUMMARY AND INDUSTRY CHARACTERIZATION

a. Introduction. In this study* we have examined the economic impact on the textile industry of the effluent guidelines for:

- the best practicable technology (BPT),
- the best available technology (BAT), and
- new source performance standards (NSPS).

We divided the textile industry into seven categories for the purpose of establishing effluent guidelines. They are:

- Wool scouring,
- Wool dyeing and finishing,
- Greige goods mills,
- Woven fabrics dyeing and finishing (cotton and synthetics),
- Knit fabric dyeing and finishing (cotton and synthetics),
- Carpet mills, and
- Stock and yarn dyeing and finishing.

We then examined the economic impact of the guidelines for five of the above categories. They are:

- Wool scouring,
- Wool dyeing and finishing,
- Woven fabric dyeing and finishing (cotton and synthetics),
- Knit fabric dyeing and finishing (cotton and synthetics), and
- Stock and yarn dyeing and finishing.

We eliminated the other two categories – greige goods mills and carpet mills – from this initial study of the economic impact on the assumption that they would not be significantly impacted by the effluent guidelines. We have also set aside large integrated mills which should not be significantly impacted since most have already complied with BPT and should be able to pass on the added costs of BAT compliance.

b. Methodology. This study is divided into two parts. The first part discusses the economic impact that the effluent guidelines may have upon the five categories. For each of the categories studied, we conducted personal interviews with operating mills which we used in conjunction with telephone interviews with operating mills and other industry sources, as well as the contractor's textile industry specialists.

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*In this report, a plant is a treatment plant and a mill is a textile manufacturing facility.

The second part of the study consists of profiles of the five categories studied based upon published information, in-house information, and other readily available sources. Each category is profiled in terms of the number of mills, size distribution, type of product, financial status, type of plant, geographic distribution, and sector segments to be affected by the guidelines.

We then developed composites of different sized mills believed to be representative of mills within each category. The dimensions of each composite mill are presented in terms of annual sales, profit, depreciation expense, cash flow, production, waste loads, water usage, and similarly related dimensions.

We then used each composite mill as the basis for calculating annual operating costs and investments necessary for pollution control within its category and mill size. For example, we applied the waste load and water usage estimated for each composite mill to the methodology of Appendix A to determine the operating costs and investment for each level of treatment.

To measure the impact in terms of mill closings, we assumed a mill would close only if the annual cost of treatment exceeded the annual cash flow of the mill.

We next compared the estimated range of cash flows to the annual operating cost, and we assumed no mill would close if the minimum annual cash flow exceeded the estimated incremental annual operating costs of effluent treatment. In those cases where the annual operating costs of treatment exceeded the minimum estimated cash flow, but did not exceed the maximum cash flow, we estimated the number of plant closings as a percentage proportional to the linear relationship between the operating cost and the cash flow. For example, if the cash flow ranged between $0 and $1000 and the annual operating costs were $250, then 25% of the mills operating in this category and size classification would be expected to close.

We believe that since a large majority of the mills of small and medium size within the five categories studied are privately held companies or corporations, the zero or negative cash flow criterion most closely approximates the criteria actually (but perhaps never formally) applied to the decision of a mill closing.

There are an unknown number of mills which face imminent closing decisions and the necessity of meeting the proposed effluent guidelines, and the attendant investments and operating costs will merely hasten the final decision to close the mill rather than actually cause its closing, i.e., being the sole factor. There will undoubtedly be closings that will be ostensibly associated with the mills' inability to meet the investment and operating costs required by the proposed effluent guidelines. Based upon the industry sources and interviews undertaken in support of this study, we estimate that as many as one-half of the mill closings which occur as a result of the proposed effluent guidelines will simply be accelerated closings, ie., the mill would have closed spontaneously without the necessity of meeting the effluent guidelines.

We have presented the investments and annual operating costs against a background of how a mill would finance its new investments in waste treatment equipment. While an important criterion which may in and of itself lead to mill closings, we have not used this as the closing criterion, but rather have selected the zero or negative cash flow as the criterion. We reason that far fewer mills will have great difficulty financing the investment than those which simply cannot afford the annual operating costs.

We have derived other impacts on employment and production directly from the estimated number of mill closings. We have treated tangential impacts, such as those relating to community pricing, financial and foreign trade, for the most part independently.

The impact on a specific mill and/or on a group of mills that form a slightly different composite can be estimated with material presented in the appendix of this study. This material permits estimates of the initial investment and annual operating costs for pollution control. The cash flow criterion for a mill closing or other criteria, such as profitability or rate of return on invested assets, can then be applied.

We assumed that the larger companies would pass on BAT treatment costs as a price increase, and that the small- and medium-size firms would benefit by incrementally greater revenues and thus ameliorate the impact that each would feel as a result of meeting the BAT guidelines.

Thus, if competitive conditions prevailing in 1983 permit large mills to pass on the incremental cost of BAT as a price increase, then the impact on small- and medium-size mills may be reduced as they too pass on a proportion of these costs. The proportion that the small- and medium-size mills may pass on is equal to the percentage price increase times their annual sales. The resulting increase in revenues may not cover all the incremental BAT costs for small and medium-size mills and some may still be impacted and may even have to close.

Recognizing that the cost of treatment per pound for small- and medium-size mills may be greater than the cost of treatment by large mills, we have allowed the small- and medium-size mills to increase their revenues only by the amount equivalent to the cost of treatment by large mills. For example, if a large mill has a treatment cost of $0.003/lb, a small mill may have a treatment cost of $0.004/lb; the latter would be required to absorb $0.001/lb from its cash flow or other sources.

To complete the analysis we added the incremental revenue that would be generated by the price increase to the cash flows of each representative size mill. This would result in a new level of cash or funding available in 1983 to defray BAT treatment costs.

c. **Waste Treatment Costs.** The costs of alternate waste treatment methods to meet the guidelines have been calculated on the basis of initial capital investment and annual operating costs for each of the composite mills. The basis for these calculations are described in detail in Appendix A, and the results of this analysis are presented in Table 1-1.

TABLE 1-1

INVESTMENTS AND OPERATING COSTS TO MEET BPT AND BAT GUIDELINES

	Categories																
	(1) Wool Scouring		(2) Wool Finishing			(4) Woven Finishing				(5) Knit Finishing				(7) Stock & Yarn Dyeing			
	S/M	L	S	M	L	S	M	L (A)*	L (B)*	S	M	L (A)*	L (B)*	S	M	L (A)*	L (B)*
Production (1000 lb/day)	22.5†	52.8†	9.5	33.5	55	9.0	72.5	100	150	15.0	40	80	120	11	24	40	60
Water Use (gal/lb)	3.0	3.0	13.8	13.8	13.8	18	18	18	18	20	20	20	20	22	22	22	22
Treatment Plant Size (mgd)	0.068	0.19	0.13	0.46	0.76	0.16	1.3	1.8	2.7	0.3	0.8	1.6	2.4	0.23	0.53	0.88	1.32
BOD Removed (lb/day)	2048	4804	876	3089	5071	236	1900	2620	3930	332	884	1768	2652	520	1040	1732	2598
BPT for mills required to meet normal guidelines																	
($'000)																	
Capital Investment	151	265	98	205	278	86	278	342	442	117	200	304	397	110	170	227	293
Annual Costs	41	71	30	59	79	27	79	96	123	35	57	86	111	33	49	65	83
BPT for mills qualifying as Commission Finishers																	
Commission Finishing																	
($1000)																	
Capital Investment	–	–	–	–	–	87.1	284.2	350.0	453.5	119.4	205.3	313.5	410.3	111.2	172.2	230.2	297.6
Annual Costs	–	–	–	–	–	27.05	79.3	96.5	123.7	35.2	57.3	86.5	111.8	33.05	49.1	65.2	83.3
BAT (incremental)																	
($1000)																	
Capital Investment	107	156	197	349	441	217	570	668	816	286	452	651	770	256	372	473	574
Annual Costs	28	43	49	89	114	54	152	181	228	72	118	174	213	64	95	124	153
BAT (including BPS)																	
($1000)																	
Capital Investment	258	421	295	554	719	303	848	1010	1258	403	652	955	1163	386	542	700	867
Annual Costs	69	114	79	148	193	81	231	277	351	107	175	260	324	97	144	189	236

*Two mills -- (A) and (B) -- were selected to provide a range of costs for large mills.

Large mill (A) was used to provide additional revenues to meet BAT guidelines.

†Based on clean (degreased) wool product weight.

The production levels listed in Table 1-1 are based upon the small- and medium-size representative mills presented in Section 1-f – Industry Profiles. We also selected the examples of larger mill sizes shown in Table 1-1, to use as a basis for calculating expected price increases for finished goods that the larger mills may pass on to help defray the costs of BAT.

Costs for best practicable technology waste treatment have been calculated on the assumption that extended biological treatment would enable a mill to meet the guidelines for BOD, COD, and color.

Best practicable technology (BPT) for the textile industry, as specified by the EPA, includes pretreatment of wastes (screening and 8-hour holdup) and subsequent municipal treatment, or alternatively, self-treatment by preliminary screening, primary settling (wool scouring only), coagulation (carpet mills only), and secondary biological treatment by extended aeration and stabilization ponds.

Pretreatment guidelines for discharge to a municipal treatment system are equivalent to BPT and BAT guidelines with regard to "incompatible" pollutants – COD, total chromium, sulfide, phenol and oil and grease (the latter for wool scouring only).* The exception is where the municipal treatment plant is committed in its NPDES permit to remove a specified percentage of any incompatible pollutant, in which case the standard for the pollutant may be correspondingly reduced. Further, the Development Document** indicates that such incompatible pollutants may be reduced to acceptable limits by in-plant process changes. Therefore, for this economic analysis we assumed that screening and an eight-hour holdup tank represent adequate pretreatment prior to discharge to the municipal waste water treatment plant.

Because of the low annual operating costs associated with the treatment described above, we further assumed that, on the basis of field visits, such pretreatment is presently being practiced by small- and medium-size mills that are connected to municipal systems. In addition, new capacity when built, will most likely take the form of either expansions to existing large mills, or will be new large mills located where self-treatment will likely be the treatment mode. Therefore, mills connected to municipal treatment plants were not considered as a part of the mill closing analysis.

Guidelines for commission finishers allow a greater variability of wastes, since commission finishers are expected to handle a wider variety of fibers, fabrics, and dyes than non-commission houses, and to operate on much shorter runs of a given production lot. The less stringent guidelines allowed to commission finishers will, therefore, have a negligible effect on treatment system costs, as can be seen in Table 1-1. We calculated the BPT costs of Table 1-1 for both commission and non-commission finishers, but because of the small differences, coupled with the added uncertainty of costs to comply with BAT, we did not calculate the BAT costs for commission finishers.

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*EPA Textile Industry Point Source Category Effluent Guidelines and Standards, Federal Register, Vol. 39, No. 130, Part II, July 5, 1974.

**EPA-440/1-74-022a, Development Document for Effluent Limitations Guidelines and New Source Performance Standards for the Textile Mills Point Source Category, June 1974.

New source standards have been established as being equivalent to BPT, except that suspended solids are restricted to 0.64 times that allowed BPT. This performance is expected to be achieved by the same technology as used for BPT, but with the addition of multi-media filtration. We have ignored the new source standards in this analysis on the basis of the following assumptions.

- In the foreseeable future, most added capacity in the textile industry will take the form of additions to existing mills, and so will not constitute "new sources";

- Those grass-roots mills that are constructed will probably be "large" mills because of the economics of size, and hence do not fall within the criteria established in this study as mills subject to closure.

Best available technology (BAT) for the textile industry, as specified by the EPA, includes the preliminary screening, primary settling (wool scouring only), coagulation (carpet mills only), secondary biological treatment by extended aeration and stabilization ponds, listed under "best practicable technology." In addition, it includes lime treatment and multi-media filtration.

d. Financial Profiles. We derived financial profiles for each category from field interviews, contractors' in-house knowledge, and other industry sources. The profiles represent commission houses, with the exception of the small raw wool scouring and wool dyeing and finishing categories. A summary of pertinent financial data drawn from each composite mill representation of its category and size classification is presented in Table 1-2.

e. Estimated Impacts. We estimated the impact of the guidelines on prices, plant closings, unemployment, communities, international trade, and other areas for each of the five categories. A summary of our findings is given below.

(1) Prices. In general, industry sources state that any added costs cannot be readily passed on to the mills' customers, since the mills affected are the smaller, independent companies which work in the aftermarket of small lots for fill-in needs of their customers. Their price structure is determined by the larger corporations which do the volume production. The smaller firms may charge a small premium of 5% or so on the going rate, but if much more than that is charged, the larger mills will undertake the work. The larger companies have already accomplished much of the expenditures necessary to meet the best practicable treatment (BPT) guidelines and, presumably, their present prices reflect this and other factors such as overseas competitive effects. Specific category comments follow.

TABLE 1-2

FINANCIAL PROFILE SUMMARY – TEXTILE INDUSTRY
(categories included in this study)

Category	1. Raw Wool Scouring		2. Wool Dyeing and Finishing		
Mill Size	Small	Large	Small	Medium	Large
Sales/Year	$1,200,000	$7,500,000	$1,075,000-$5,375,000	$5,375,000-$17,500,000	$190,000,000
Profit after Taxes	$0-$4,400	$113,000	$0-$174,000	$0-$554,000	$0-$600,000
Depreciation Expenses	Negligible	Negligible	$10,800-$54,000	$53,800-$175,300	$190,000
Principal Repayment	Not Known	Not Known	Not Known	Not Known	Not Known
Annual Cash Flow	$0-$4,400	$0-$65,000	$10,800-$223,000	$53,800-$729,300	$190,000-$790,000

	4. Broad Woven, Dyeing, and Finishing			5. Knit Fabric Dyeing and Finishing		
	Small	Medium	Large	Small	Medium	Large
Sales/Year	$1,060,000-$2,120,000	$8,480,000-$15,900,000	$16,700,000	$1,605,000-$3,210,000	$5,082,500-$8,560,000	$13,700,000
Profit after Taxes	$0-$72,600	$0-$502,600	$0-$530,000	$0-$90,000	$112,200-$540,600	$290,000-$865,000
Depreciation Expenses	$74,200-$148,400	$593,600-$1,113,000	$1,170,000	$160,500-$321,000	$508,250-$856,000	$1,300,000
Principal Repayment	Not Known	Not Known	Not Known	$64,200-$128,400	$203,300-$342,400	$550,000
Annual Cash Flow	$74,200-$221,000	$593,600-$1,615,600	$1,170,000-$1,700,000	$96,300-$282,600	$415,200-$1,054,200	$1,590,000-$2,165,000

	7. Stock and Yarn Dyeing Mill		
	Small	Medium	Large
Sales/Year	$916,400-$2,687,500	$2,687,500-$5,375,000	$6,700,000
Profit after Taxes	$0-$76,400	$62,400-$174,200	$147,000-$215,000
Depreciation Expenses	$64,000-$188,100	$188,100-$376,250	$470,000
Principal Repayment	Not Known	Not Known	Not Known
Annual Cash Flow	$64,000-$264,500	$250,500-$550,500	$167,000-$685,000

Wool scouring is a special case. The wool market has been depressed for some time and mills have been closing with fair regularity, resulting in a highly competitive situation that precludes higher pricing.

Larger broad-woven and knit mills may be able to pass on a good share of the costs in the case of the best practicable treatment, since the market there is reasonably strong. Stock and yarn dyeing mills also share a reasonably strong market at present and may be able to pass on at least a portion of the treatment costs.

Table 1-3 provides a summary of the base price currently charged for processing and the incremental price increase that would result for the various treatment costs, if these costs could be passed on, assuming no mark-up by the mill.

(2) Plant Closings and Unemployments. The major conclusions resulting from the analysis described in the preceding sections are:

- There will be no mill closings in Categories 4 and 5 due to compliance with BPT and BAT guidelines;
- Mill closures due to compliance with the BPT and BAT guidelines in Categories 1, 2, and 7 are listed below:

	Closures	
Category	BPT	BAT
1	2	0
2	2	4
7	0	1

Table 1-4 presents the summary of impact (Categories 1, 2, 4, 5, and 7), for mills which are subject to normal guidelines. The table includes the total number of mills in the category, the estimated employment, and the mills and employees potentially impacted. The BPT expected impact is based upon the "closing" model and employs the annual cash flows for 1977 and the estimated annual treatment costs for BPT.

Based upon this closing model and the associated cash flows and treatment costs, two mills in Category 2 – Wool Dyeing and Finishing – are expected to close. If this is in fact the case, then employment and production curtailment will be minimal (about 2%). Three additional Category 2 mills will be impacted in 1983 with an employment and production curtailment of 3%, and one mill in Category 7 – Yarn and Stock Dyeing and Finishing – will be impacted with an employment and production curtailment of less than 1%.

TABLE 1-3

PRICE IMPACT SUMMARY
($)

	1. Wool Scouring*		2. Wool Dyeing and Finishing		
	Small/Medium	Large	Small	Medium	Large
Base Price ($/pound of product)	0.13	1.73	$1.43		
Incremental Price for:					
BPT, Self-Treatment	0.0036	0.0027	0.013	0.007	0.0057
BAT, Self-Treatment†	0.0061	0.0043	0.033	0.013	0.0140

	4. Woven Goods Dyeing and Finishing			5. Knit Goods Dyeing and Finishing		
	Small	Medium	Large	Small	Medium	Large
Base Price ($/pound of product)	0.37-0.70			0.53		
Incremental Price for:						
BPT, Self-Treatment	0.0120	0.0044	0.0038	0.0078	0.0048	0.0034
BAT, Self-Treatment	0.0360	0.0827	0.011	0.0233	0.0146	0.0102

	7. Stock and Yarn Dyeing		
	Small	Medium	Large
Base Price ($/pound of product)	0.54		
Incremental Price for:			
BPT, Self-Treatment	0.0120	0.0065	0.0052
BAT, Self-Treatment	0.0353	0.0192	0.0151

*Based on weight of grease wool, not finished product.

†Includes BPT costs.

TABLE 1-4

SUMMARY OF IMPACT FOR MILLS SUBJECT TO NORMAL GUIDELINES – CATEGORIES 1, 2, 4, 5, AND 7

	Category								
	(1) Wool Scouring	(2) Wool Dyeing & Finishing		(4) Broad Woven Dyeing & Finishing		(5) Knit Fabric Dyeing & Finishing		(7) Stock and Yarn Dyeing	
Total Mills in Category	5	76		208		455		128	
Total Employment in Category	557	9,400		27,700		30,500		8,300	
Mill Size	Small & Medium	Small	Medium	Small	Medium	Small	Medium	Small	Medium
Mills Potentially Impacted	0	20	12	9	5	3	1	22	4
Employees Potentially Impacted	0	1,800	3,600	675	2,250	120	100	500	240
BPT Expected Impact									
Annual Cash Flow		$10,800	$53,800	$74,200	$593,600	$96,300	$417,200	$64,000	$250,500
Circa 1977		$223,000	$729,300	$221,000	$1,615,600	$282,600	$1,054,200	$264,500	$550,500
Annual Treatment Cost for BPT		$30,000	$59,000	$27,000	$79,000	$35,000	$57,000	$33,000	49,000
Expected Mill Closings Caused By Implementation of BPT — Mills	0	2	0	0	0	0	0	0	0
Employment	(0)	(180)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Percentage Impact — Mills	0	0	2.6%	0		0		0	
Employees	0	0	1.9%	0		0		0	
Production	0	0	1.9%	0		0		0	
BAT Expected Impact									
Cash Available in 1983 to Defray BAT Treatment		$17,000	$88,600	$84,100	$675,800	$120,000	$492,300	$83,300	$307,000
Costs* (Equals Annual Cash Flow Plus Incremental Revenues)		$257,800	$828,100	$240,700	$1,639,400	$330,100	$1,180,800	$321,000	$663,500
Annual Treatment Costs BAT (includes BPT)		$79,000	$148,000	$81,000	$231,000	$107,000	$175,000	$97,000	$144,000
Mill Closing (After Price Increase) Due to BAT									
Mills	0	3	1	0	0	0	0	1	0
Employment	(0)	(270)	(90)	(0)	(0)	(0)	(0)	(23)	(0)
Percentage Impact — Mills	0	5.3%		0		0		0.8%	
Employ	0	3.8%		0		0		0.3%	
Production	0	3.8%		0		0		0.3%	

*If competitive conditions prevailing in 1983 permit large mills to pass on the incremental cost of BAT as a price increase, then the impact on small and medium size mills may be reduced as they too pass on a proportion of these costs. The proportion that the small and medium mills may pass on is equal to the percentage price increase times their annual sales. The resulting increase in revenues may not cover all incremental BAT treatment costs and some mills may still be impacted.

Table 1-5 presents the summary of impact for mills qualifying under the commission finisher exemption and thus subject to a separate set of guidelines. The impact was estimated in the same manner that it was for mills complying with normal guidelines. Two mills in Category 1 – Wool Scouring – are expected to close in 1977, and these closures may be attributed to effluent guidelines.

We believe that these two mills, both located in Massachusetts, may close in spite of the effluent guidelines, simply with the passage of time and the further diminished demand for scoured wool. If the wool market should reverse its trends, then these mills might be subject to impact because of the guidelines and/or they might be in a satisfactory financial condition perhaps to meet their operating costs from operating revenues. The latter occurrence is not anticipated, however.

In addition, compliance with BAT guidelines can be expected to cause closure of three additional small yarn and stock dyeing and finishing mills, again with an employment and production curtailment of less than 1%.

(3) Community Impacts. A large percentage of the small- and medium-sized independent mills is located in small communities where the mills hold a significant position. They often account for up to 5% of a town's direct employment, and sometimes as much as 30%. Hence, although the impact may be small in light of the total industry, local impacts will be significant.

(4) International Trade. In terms of international trade, the impact of the guidelines on the industry appears to be of little consequence. If, in fact, the guidelines produced a much greater effect than predicted in this study, imports would be further encouraged since the smaller, independent mills provide the fast turnaround on small lots that neither the large domestic mills nor the overseas mills can provide.

(5) Study Limitations. This study was undertaken to permit an estimate of the economic impact that the effluent guidelines may have upon certain subcategories of the textile industry, in terms of potential mill closings. The level of effort permitted resulted in an analysis that was more judgmental than analytical. The major economic impact that will occur within the textile industry will occur to companies which are generally small, privately held, and are very reticent and, in many cases, actually refused to reveal details of their financial profitability and expected impact of the effluent guidelines on their businesses. Responsible and knowledgeable people were contacted for discussion of the composite mill for each subcategory and size classification and these persons believe that the composites are representative of their category and size classification. On that basis the study is presented as an initial view of the impact that the proposed effluent guidelines will have upon this industry.

TABLE 1-5

SUMMARY OF IMPACT FOR MILLS QUALIFYING UNDER COMMISSION FINISHER EXEMPTION

Commission Finishers Drawn from Category	(1) Wool Scouring	(2) Wool Dyeing & Finishing		(4) Broad Woven Dyeing & Finishing		(5) Knit Fabric Dyeing & Finishing		(7) Stock & Yarn Dyeing	
Total Commission Finishers Drawn from Each Category	7	3		131		76		64	
Estimated Employment	720	0		28,500		3,900		1,860	
Mill Size	Small & Medium	Small	Medium	Small	Medium	Small	Medium	Small	Medium
Mills Potentially Impacted	3	0	0	81	50	62	14	53	11
Employees Potentially Impacted	465	0	0	6,000	22,500	2,500	1,400	1,200	660
BPT Expected Impact									
Annual Cash Flow Circa 1977	$0-$65,000	$10,800-223,000	$53,800-729,300	$74,200-221,000	$593,600-1,615,600	$96,300-282,600	$417,200-1,054,200	$64,000-264,500	$250,500-550,500
Annual Treatment Cost for BPT	$41,000	$30,000	$59,000	$27,000	$79,000	$35,000	$67,000	$33,000	$49,000
Expected Mill Closings Caused By Implementation Of BPT No. Mills	2	0	0	0	0	0	0	0	0
No. Employees	(165)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Percent Impact Mills	29.0%	0		0		0		0	
Employees	22.9%	0		0		0		0	
Production	22.9%	0		0		0		0	
BAT Expected Impact									
Cash Available in 1983 to Defray BAT Treatment Costs (Equals Annual Cash Flow plus Incremental Revenues)	$20,000-$106,000	$17,000 to $257,800	$88,600 to $828,800	$84,100 to $240,700	$675,800 to $1,639,400	$120,000 to $330,100	$492,300 to $1,180,800	$83,300 to $321,000	$307,000 to $663,500
Annual Treatment Costs	$69,000	$79,000	$148,000	$81,000	$231,000	$107,000	$175,000	$97,000	$144,000
Expected Mill Closings (After Price Increase) Due to BAT									
No. Mills	0	0	0	0	0	0	0	0	0
No. Employees	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Percent Impact Mills	0	0		0		0		0	
Employees	0	0		0		0		0	
Production	0	0		0		0		0	

Follow-on studies, should they be required, can build upon the methodology used in this study to improve the understanding of the impact that the guidelines will have upon this industry. For example, the number of interviews conducted could be increased to a point that forms a statistically valid sample of the industry in each category. We anticipate that the statistical sample will be developed on the basis of personal interviews and the balance of the industry could be conducted by means of mail questionnaires sent to companies listed in Davidson's Blue Book or similar directories.

f. Industry Profiles

(1) Category 1 – Raw Wool Scouring

(a) Current Status

- Outlook. The consumption of clean wool in the United States declined drastically between 1960 and the present, dropping from 411.1 million pounds in 1960 to 219.2 million pounds in 1972.* Current annual U.S. production is estimated at 131 million pounds+ of clean wool, and there is about 50% excess production capacity now available (based on a 3-shift, 5-day week, 50-week year). This severe curtailment of wool production is resulting in an accelerated shutdown trend with at least one mill closing per year. The surviving mills and the individual status of each is shown in Table 1-6.

The sharp decrease in production has been attributed to a very poor wool market between 1968 and the present. Conditions were initially depressed because of the rise in popularity of synthetic fibers which had the double impact of cutting strongly into the wool fiber market, followed by the need to "fill the pipeline" with the new synthetic fabrics. Knit synthetic fabrics were the dominant fabric type causing this impact. Subsequently, wool production was curtailed and foreign purchase of wool (mostly Japanese) combined to create a world wool shortage, which served to inflate the price of wool.

Many mills are now working a short week, that is, one shift per day. The Wool Combing Company, Barre, Mass., one of the larger scourers, which was operating at a rate of 32 million pounds of raw wool scoured per year, shut down in May 1974, while Amos Abbot of Dexter, Maine, a small scouring firm, which also weaved and finished woolen fabric, discountinued raw wool scouring earlier in 1974. As a mill closes, its business becomes divided among the survivors, permitting a sort of respite until the advent of the next crisis.

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*Source: Department of Agriculture Textile Organon

+ADL Survey, May 1974.

TABLE 1-6

PROFILE OF THE RAW WOOL SCOURING INDUSTRY

Company	Commission Scouring	Commission Top	Integrated with Weaving & Finishing	Production (millions of lbs/yr)	Number of Scouring Lines	Number of Employees	Shifts	Work Week Days per Week	Recover Grease Yes	Recover Grease No	Type of Waste Treatment
Bollman Industries San Marcos, Texas	X			7.0	3	45	1	5	X		Evaporation Lagoon plus Landfill
Hudson Combing Co. Inc. Hudson, Mass		X		8.0	1	43	2	2.5		X	Evaporation Lagoon plus Landfill
Roddie Wool Scouring Co. Inc., Brody, Texas	X			56.0	7	79	1	5		X	Evaporation Lagoon plus Landfill
San Angelo Wool Processing Co., San Angelo, Texas		X		2.0	1	13	1	5	X		Evaporation Lagoon plus Landfill
Santee River Wool Combing Co. Inc., Jamestown S.C.		X		20.0	3	300				X	Aerobic Lagoon
Gilet Wool Scouring Corp. N. Chelmsford, Mass	X			6.35	4	65	1	4 (10 hr days)	X (crude)		No Treatment Waiting on Town/State/Corps
Southwell Combing Co. N. Chelmsford, Mass		X		12.0	2	100[1]	1	4 (6-7 hours)	X (refined)		No Treatment, Waiting on Town/State/Corps
Hart Wool Combing Inc. Holyoke, Mass.		X		32.0	2	75	2	5	X		Municipal: Have Town Acceptance, Waiting for Town to Build
Caron International[2] Rochelle, Ill.			X	0	1	0	0	0		X	Municipal
Columbia Wool Scouring Mills Portland Oregon			X	16	1	32	2	5	X		Municipal: Just Installing an ABCOR Molecular Sieve to Pretreat
Burlington Industries, Inc. Clarksville, Va.			X	79.2	3	350	3	5.5	X		Combined Mill Wastes By Act. Sludge: Planning Pre-treatment Grease Removal
J.P. Stevens & Co., Inc. Allendale, S.C.			X	22.5	1	150	3	4.5	X (refined)		5-day Oxidation Ditch & Clarif.
Totals	3	5	4	261.05	29	1,252	–	–	8	4	

1. Down from 850, 2 years ago.
2. Scouring is inactive at present: may be resumed.

Because of underutilization of equipment, all of which is old and already fully amortized, the commission scouring mills appear to be at – or close to – zero profit and cash flow levels, waiting for a return of the wool market. As a matter of fact, wool has just about been priced out of the marketplace, and the future does not look bright for the scouring industry.

The firms involved in both commission scouring and top making are facing the same poor market conditions as those mills performing commission scouring alone. However, some top makers own the wool they process, and hence may be in a slightly better position to stay in business a little longer – anticipating better times.

The scouring mills that are part of an integrated operation, including weaving and finishing fabric, appear to be the only scouring mills that are operating close to capacity, and they will probably survive for the immediate future. In addition, the larger scouring mills in Texas may continue also, because of their proximity to the sheep slaughter houses and the acceptance of their current waste treatment by lagooning, evaporation, and landfill. The future of the remaining mills remains in serious doubt.

The use of wool in carpets has declined even more drastically than in clothing. In fact, one carpet mill closed down its raw wool scouring operations only last year with the intent of purchasing scoured wool from abroad, but the market for woolen rugs has not warranted such purchases.

It would appear then that further attrition may be expected in this industry before wool demand possibly stabilizes and the surviving mills once more become profitable.

- Company Status. Each of the companies listed in Table 1-6 is discussed in this section.

Bollman Industries
San Marcos, Texas

Bollman, which has three scouring lines, is not operating to capacity, and performs commission work only. The firm employs 45 on two workshifts, 5 days a week, but not all its lines are operating. Bollman recovers grease and refines it for sale. Its wool yield, on the average, is 50%, but this figure varies greatly. The firm owns property in the country that contains an evaporation pond where its scouring wastes are treated. The residue from evaporation is land-filled. The State checks this operation quarterly.

* * * * * *

Roddie Wool Scouring Co., Inc.
Brady, Texas

Roddie has 7 lines and 79 employees performing commission scouring. The firm, which is the largest wool scourer, also is not running to full capacity. Roddie handles its wastes in the same manner as Bollman.

* * * * * *

San Angelo Wool Processing Co.
San Angelo, Texas

With one scouring line and 13 employees, San Angelo is operating at about 25% of full capacity. The firm, which normally has 50 employees working full time, performs commission scouring, carding, and combing, and also handles sheep skins as a separate part of its business. San Angelo recovers grease from sheep's wool, but not when processing mohair. Its waste waters pass through four settling/evaporation lagoons and a pit. The overflow is sent to the town sewer, while settled sludge is taken to a sanitary landfill.

* * * * * *

Hudson Combing Co., Inc.
Hudson, Mass.

With one scouring line and 43 employees, Hudson performs commission scouring, carding, and combing, but is running below capacity. The firm operates its scouring line for two shifts every other day. It does not recover grease. Hudson handles its waste waters in its own lagooning system and so does not discharge to streams.

* * * * * *

Santee River Wool Combing Co., Inc.
Jamestown, S.C.

Santee has two scouring lines, but one is not now in use; the second is being operated during three shifts, six days a week. Santee performs commission scouring, carding, and combing. The firm employs 300 and processes its waste water in an aerobic lagoon, but has to further treat it. Santee cannot depend on evaporation/landfill, as in the Texas mills, since rainfall exceeds the evaporation rate. Santee stated that an alliance of wool processors overseas is studying means of taking care of wool scouring wastes, but the results won't be available for a year. Meanwhile, the confusion over guidelines has left the firm in the position of not knowing what to do. No treatment approaches the firm knows to be in existence achieve close to the numbers it has seen being considered as effluent treatment goals.

* * * * * *

Gilet Wool Scouring Corp.
North Chelmsford, Mass.

Gilet is a commission scourer, employing 60-65, including supervisors. The firm has 4 scouring lines, works one 10-hour shift, 5 days a week for 50 weeks/year. Gilet has been recovering grease since 1964 and sells it as crude. The firm handles all kinds of domestic as well as imported wools, so shrinkage varies from 10 to 85% with an average of 35-40%. Its sales are based on current pricing of 7¼ to 7½ cents per pound of raw wool scoured, with a 20% surcharge added to partially cover sharply rising costs of handling.

The Town of North Chelmsford voted in funding for a treatment plant, but subsequently cancelled it. Gilet spent $85,000 on pretreatment facilities in its anticipation, so now the firm doesn't know what to do. Mr. Gilet made the point that if funds were to be made available to implement the 2 year-old Bill that Congress passed that provides 3%-30 year money for constructing treatment plants, Gilet could probably meet guidelines and stay in business.

* * * * * *

Southwell Combing Co.
North Chelmsford, Mass.

Southwell Combing is a scouring-top making operation, mostly commission. The firm, which employs 100 (down from 850 several years ago), has two scouring lines and works one shift (6-7 hours) 4 days a week. Southwell recovers grease and sells it as a neutral grease at 2% moisture. The firm also does a small amount of dry processing on synthetics and chlorine shrinking work. If the firm has to discountinue scouring, it would go out of business completely. Actually Southwell is in the same situation with respect to municipal treatment as Gilet – the Town having cancelled plans for a treatment plant.

* * * * * *

Hart Wool Company, Inc.
Holyoke, Mass.

With two scouring lines and an employment of 75, Hart works two shifts, five days a week. The firm recovers grease, and has had its waste waters accepted by the City of Holyoke which is proceeding with a municipal plant. Although Hart is a commission scourer, carder, and comber, it does much of its work for its own top company.

* * * * * *

Caron International
Rochelle, Ill.

Caron has one scouring line, but it is inactive. This is an integrated mill with spinning and weaving of fabric. With the current poor wool market, Caron is handling mostly synthetics. The firm may start up the wool scouring mill if the market turns up. Its wastes are accepted by the municipal plant. The firm does not recover grease.

* * * * * *

Columbia Wool Scouring Mills
Portland, Oregon.

Columbia is part of the Pendleton woolen mills, and all of its output goes to Pendleton. The firm recovers lanolin and is selling it at anywhere from $0.45 to $0.68 per pound (most lanolin goes for $0.25/lb). Columbia works two shifts a day all year-round and three-shifts for about four months during Pendleton's peak season, and works a 5-day week. The firm employs 32 (counting supervisors and a secretary), and operates one four-tank scouring line. The firm is acquiring an ABCOR membrane (molecular sieve) to treat the grease recovery centrifuge effluent before discharging to the municipal sewers. This constitutes a pretreatment for municipal treatments. Presumably it will remove all greases and oils but will leave a BOD load due to the detergent. Columbia does not recycle its waste water; once through, it then dumps it.

* * * * * *

Burlington Industries, Inc.
Clarksville, Va.

Burlington Industries (BI) has closed down its raw wool scouring operations at Lee's Carpet Division in Virginia permanently. At Clarksville, the firm does not do any commission scouring: all its output goes to the Clarksville finishing plant. BI employs about 350 in the scouring and top making area, and operates three scouring lines, five to six days per week, on three shifts. It recovers 30-40% of the wool grease by centrifuge. It was treating its scouring wastes, combined with the finishing mill wastes, but is about to obtain bids on systems to pretreat its scour waste before combining for an activated sludge treatment. BI is considering air flotation among other methods. The firm talked with ABCOR last November, but at that time ABCOR's only experience was with whey, which it considers a very simple separation compared to scour wastes. BI made the point that current costs for concrete and iron pipe have skyrocketed since February of this year, putting under question any costs derived prior to that time.

* * * * * * *

J.P. Stevens, Inc.
Allendale, S.C.

Stevens operates one scouring line on three shifts for 4-5 days per week. All its output is used by Stevens. Stevens has secondary treatment and has been reported upon in the guidelines studies. The firm is currently providing operating data to EPA.

(b) Number of Establishments. The 1967 Census of Manufactures indicated 68 establishments engaged in wool scouring and/or worsted combing. A contractor survey taken in May 1974 found only 12 scouring mills remaining with one of these currently inactive. A listing of these mills and the status of each is given in Section f (1)a above.

This sharp decrease has been attributed to a very weak wool market over the 1968-1974 period. Conditions were initially depressed because of the rise in popularity of synthetics, and later by the shortage of wool and its rise in price to a level where it was close to being priced out of the market.

There are only three mills that may be potentially impacted. These are commission mills which are not connected to municipal treatment facilities, or are not treating their wastes by evaporative lagooning and landfill, as the mills in Texas are doing. In addition, all integrated mills already have their own treatment facilities, or are connected to municipal systems, and, because of their stronger financial posture, they are not considered to be subject to impact due to the implementation of the guidelines.

The distribution of mills is summarized in Figure 1-1.

12 Scouring Mills					
4 Integrated Mills			8 Commission Mills		
1 Municipal	1 Inactive	2 Have Own Secondary Treatment	1 Municipal	4 Treat By Evaporative Lagooning and Landfill	3 No Treatment Or Inadequate Self-Treatment

FIGURE 1-1 NUMBER OF MILLS IN CATEGORY 1: RAW WOOL SCOURING

(c) Size Distribution. The active mills vary in size as shown in Table 1-7.

TABLE 1-7

CATEGORY 1
SIZE OF RAW WOOL SCOURING MILLS

Number of Scouring Lines/Mill	Number of Mills in Operation	Total Scouring Lines	Total Number of Employees
1	4	4	238
2	2	4	175
3	3	9	695
4	1	4	65
7	1	7	79
	11	28	1,252

Production in the raw wool scouring mills ranges from 2 to 80 million pounds of grease wool processed per year. Actual production per mill is dependent on both the number of scouring lines and the number of shifts worked per week.

The number of employees involved with each operation runs roughly to 14 employees per scouring line per shift. When top making is included in the same mill with scouring, as many as 50 employees may support each scouring line.

(d) Number of Employees. The total direct labor employment in the raw wool scouring industry is currently 1,252.* The three mills which will potentially be impacted have a total current employment of 465.

(e) Composite Raw Wool Scouring Mill. The wool scouring mills assumed subject to impact are the commission scouring and top-making mills that are not connected to municipal treatment plants. The Texas mills will not be impacted since they are using evaporative lagoons and sanitary landfill. The representative mill uses a basis of raw wool processed and assumes that the mills represented are strictly commission houses that conform to the definition of a commission finisher.

We obtained limited financial data from spokesmen of these mills that indicated the following:

Scouring Mill:	Profit – negative
	Cash Flow – close to zero
Scouring and Top Mill:	Profit – zero
	Cash Flow - zero

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*Contractor Survey, May 1974.

In addition, we were told that the "before tax" profit for commission houses is no higher than 1-1/2% on sales.

Present charges for commission work are approximately $0.10 per pound of grease wool scoured, and $0.30 per pound of grease wool scoured and processed into top. These figures include baling for shipment. Table 1-8 presents the financial status of representative commission raw wool scouring mills.

TABLE 1-8

REPRESENTATIVE COMMISSION RAW WOOL SCOURING MILLS

	Small	Large
Profit (before taxes)	0-1-1/2% $0-$20,000	0-1-1/2% $0-$112,500
Profit (after taxes)	0-1/2% $0-$4,000	0-3/4% $0-$65,000
Depreciation	Negligible	Negligible
Debt Repayment	Unknown	Unknown
Cash Flow	$0-$4,400	$0-$65,000
Salvage	Negligible	Negligible
Cost Structure		
Fixed	19% $228,000	19% $1,425,000
Variable	81% $972,000	81% $6,075,000
Production (grease wool basis)	12,000,000 lb/year 48,000 lb/day	25,000,000 lb/year 100,000 lb/day
Work Week	5 Day, 1 Shift	5 Day, 1 Shift
Water Use (grease wool basis)	18 MGY 0.07 MGD 1.5 gal/lb	30 MGY 0.12 MGD 1.5 gal/lb

(2) Category 2 — Wool Fabric Dyeing and Finishing

(a) Number of Establishments. According to the 1967 Census of Manufactures, 310 mills were engaged in the manufacture of woolen and worsted woven fabrics, including dyeing and finishing. The Census breakdown by size is given in Table 1-9, and Figure 1-2 shows the number of mills potentially impacted and their size distribution.

TABLE 1-9

WEAVING AND FINISHING WOOL FABRICS – SIZE DISTRIBUTION

		No. of Establishments	No. of Employees (000's)
Total establishments		310	41.8
Establishments with an average of:			
1 to	4 employees	54	0.1
5 to	9 employees	17	0.1
10 to	19 employees	22	0.3
20 to	49 employees	64	2.0
50 to	99 employees	41	2.9
100 to	249 employees	60	10.3
250 to	499 employees	35	12.2
500 to	999 employees	14	13.9
1,000 to	2,499 employees	3	–

Source: 1967 Census of Manufactures

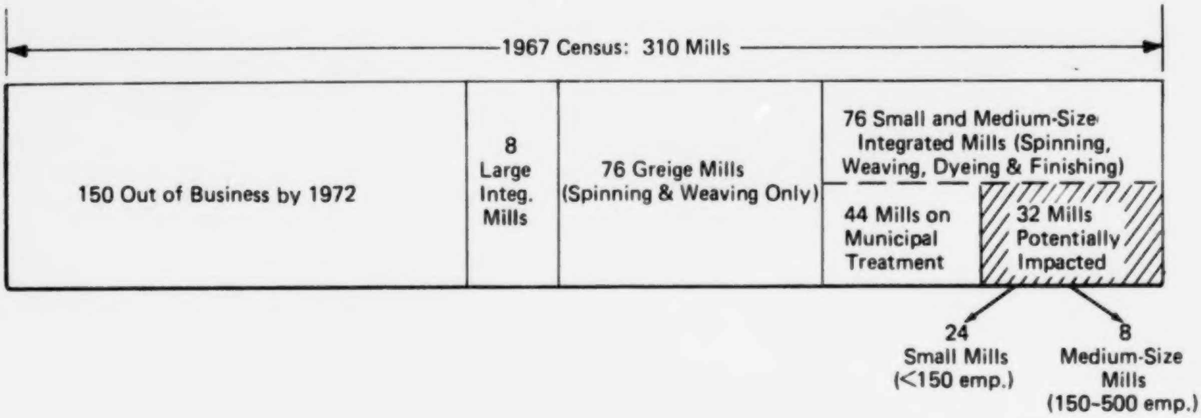
1967 Census: 310 Mills
150 Out of Business by 1972
8 Large Integ. Mills
76 Greige Mills (Spinning & Weaving Only)
76 Small and Medium-Size Integrated Mills (Spinning, Weaving, Dyeing & Finishing)
44 Mills on Municipal Treatment
32 Mills Potentially Impacted
24 Small Mills (<150 emp.)
8 Medium-Size Mills (150-500 emp.)

FIGURE 1-2 NUMBER OF MILLS IN CATEGORY 2 – WOOL FABRIC DYEING AND FINISHING

We estimate that 150 of these mills have gone out of business since the 1967 Census.*

We estimate that there are eight large, integrated mills performing spinning, weaving, dyeing and finishing that are assumed capable of complying with both BPT and BAT guidelines.

Of the remaining 152 mills, we estimate that 50% (76 mills) have dyeing and finishing facilities.

Of these 76 small- and medium-size mills with dyeing and finishing facilities, we estimate that 44**are discharging to municipal treatment plants, and 32 have their own treatment plants, or are discharging without treatment, and hence will be potentially impacted only by required compliance with the guidelines. None of these latter mills appears to be a commission house by the definition of commission house used in this report. Integrated mills, however, occasionally perform some commission finishing in addition to their own work.

(b) Size Distribution and Employment. Of the 32 potentially impacted non-commission mills, 20 are small-size mills, while 12 are medium-size mills, assuming the same ratio as found in the 1967 Census for small mills employing less than 150 and medium-size mills employing more than 150.

The number of employees potentially impacted is shown in Table 1-10, for small-size mills employing less than 150 and for medium-size mills employing between 150 and 500, based on the employment shown in the representative mills.

TABLE 1-10

NUMBER OF EMPLOYEES POTENTIALLY IMPACTED IN CATEGORY 2 – WOOL FABRIC DYEING AND FINISHING

		No. of Employees
Non-commission mills (32) potentially impacted:		5,400
Composed of 20 small mills:	1,800	
and 12 medium mills:	3,600	
Non-commission mills (44) connected to municipal treatment		4,000
Total		9,400

---

* Based on a review of Davison's Textile Directory, Sixty-Second Annual Edition, 1973 Davison Publishing Co., and ADL non-proprietary information.

** The number of small- and medium-sized mills on municipal systems is based on a June 6, 1972, Northern Textile Association survey of woolen mills in New England and Pennsylvania, in which 21 mills out of 29 reporting were on municipal systems. Of the remaining 47 mills, we assumed 50% to be on municipal systems. In addition, most wool mills are handling some synthetics as well as wool, since the poor wool market conditions occurred.

(c) Types of Plants. With the exception of four to six of the largest manufacturers, equipment for both weaving and finishing proved to be outmoded, and the level of technology was below average compared to competing European and Japanese mills.

(d) Geographic Distribution. Table 1-11 gives the geographic distribution of wool weaving and finishing mills in 1967 and shows that, of the total 310 mills, the northeast region accounted for two-thirds of the industry. In the north central region there were 22 establishments, 52 in the southern region, and 20 in the western region.

(e) Types of Products. The wool fabric industry basically produces two types of products:

(1) Worsted fabrics, the raw material of which is wool top. This is woven into medium- and light-weight fabrics, and is mostly used in men's tailored clothing, including slacks. Fabrics are 100% wool or of a blend of wool and polyester.

(2) Woolen-type fabrics that are composed of medium-weight and heavy fabrics and are utilized in both men's and women's sportswear. These fabrics are made of 100% wool or blends of various fibers with wool.

Because the raw materials of wool have doubled in price and the supply has been curtailed over the past 18 months, very few mills in the United States classified under this segment are engaged in the manufacture of 100% wool content fabric. In most cases, both in worsted- and woolen-type fabrics, blends of wool with other fibers are being manufactured.

(f) Segments to be Affected. Of the 310 establishments accounted for in the 1967 Census of Manufactures, we estimate about 150 of these went out of business between 1967 and 1972. Of the remaining mills, eight of the largest establishments have integrated weaving, dyeing, and finishing facilities, and account for 70% of the total fabric output. Of the remaining 152 mills, we estimate that 50%, or 76 of the mills, have their own dyeing and finishing facilities, and hence will be exposed to impact by the guidelines.

(g) Financial Profile. No pertinent information is available on mills exclusively engaged in woolen weaving, dyeing, and finishing, since the major factors in this business are divisions of large diversified textile companies, where the wool portion is only a small percentage of the total volume.

TABLE 1-11

WOOL WEAVING AND FINISHING MILLS – GEOGRAPHIC DISTRIBUTION*

	No. of Establishments	No. of Employees (000's)
United States	310	41.8
Northeastern Region	216	22.2
New England Division	127	16.3
Maine	18	4.0
New Hampshire	16	3.6
Vermont	7	.4
Massachusetts	41	4.8
Rhode Island	36	2.2
Connecticut	9	1.1
Middle Atlantic Division	89	5.9
New York	39	3.2
New Jersey	10	.6
Pennsylvania	40	2.1
North Central Region	22	1.3
East North Central Division	12	.9
Ohio	5	2.5-5.0
Illinois	3	–
Wisconsin	2	–
West North Central Division	10	.5
Minnesota	6	–
Missouri	3	.2
South Region	52	17.2
South Atlantic Division	43	15.0
Maryland	3	1.0
Virginia	10	2.5
West Virginia	1	.5
North Carolina	6	4.0
South Carolina	11	2.5
Georgia	11	2.5
East South Central Division	7	1.0–2.5
Tennessee	2	1.0
Alabama	2	1.0
West South Central Division	2	–
Texas	2	–
West Region	20	1.1
Pacific Division	18	1.0–2.5
Washington	1	.5
Oregon	8	.5
California	9	.2

Source: Census of Manufactures, 1967

*The subtotals do not add up to totals, in all cases, since all geographic areas are not necessarily included.

(h) Composite Wool Dyeing and Finishing Mills. The financial data of composite wool fabric finishing mills are presented in Table 1-12.

The composite mills are integrated mills performing spinning, weaving, dyeing, and finishing. The dry operations, such as spinning and weaving, are more profitable than dyeing and finishing, and help to carry the latter operations. Mill owners prefer to carry wet operations in spite of their poor financial performance, since they provide the ability of fast response to an after-market when cutters need small lots of the more popular styles and shades, which the larger corporations find difficult to handle economically.

The price for finished wool fabric would be approximately $3.50 to $4.00 per pound for a large mill that owns its own wool and handles only wool. However, we have observed that wool fabric mills are performing some commission work and are also processing synthetic fibers as well as wool; these factors reduce the sales value per pound of product to a level ranging $1.28 to $1.46 per pound. These figures were used in this analysis.

The same remarks about the wool market made in Section f(1)b above, Raw Wool Scouring, apply to the wool fabric dyeing and finishing setment of the textile industry: the market is depressed, which is the reason for the price modifications given above.

(3) Category 4 – Broad Woven Fabrics – Dyeing and Finishing (Cotton and Synthetics)

(a) General. According to the Census of Manufactures, during 1967 a total of 449 establishments were engaged in the dyeing and finishing of synthetic and cotton woven goods. Table 1-13 illustrates the relative position of cotton finishing plants and synthetic finishing plants between 1958 and 1970. During that period there was a drastic reduction of employment. In cotton finishing plants, an employment level of 49,000 in 1958 declined to 29,000 in 1970. Employment in synthetic finishing plants rose from 16,000 in 1958 to 34,000 in 1970. This trend directly reflects a shift in U.S. mill fiber consumption between 1958 and 1970. Other indicators, such as value added and value of shipments, also reflect this trend.

(b) Number of Establishments and Size Distribution. According to the 1967 Census of Manufactures, 449 establishments were engaged in the dyeing and finishing of synthetic and cotton woven goods. The Census breakdown by size is given in Table 1-14, which illustrates size breakdown of various plants by number of employees and illustrates the following.

- Cotton Finishing: Cotton finishing is a highly fragmented industry where small plants (50 employees and under) accounted for more than half the establishments, or 122.

TABLE 1-12

REPRESENTATIVE WOOL DYEING AND FINISHING MILLS

	Small	Medium	Large
Sales	$1,075,000 – 5,375,000	$5,375,000 – $17,500,000	$19,000,000
Profit (before taxes)	0 – 6%	0 – 6%	0-6%
	$0 – $322,500	$0 – 1,653,000	$0-$1,140,000
Profit (after taxes)	0 – 3¼%	0 – 3.2%	0.3.2%
	0 – $174,000	0 – $554,000	$0-$600,000
Depreciation	$10,800 – $54,000	$53,800 – $175,300	$190,000
Debt	Not Known	Not Known	Not Known
Cash Flow	$10,800 – $223,000	$53,800 – $729,300	$190,000-$790,000
Salvage	$270,000	$877,000	$950,000
Cost Structure			
Sales exp.	10%	10%	10%
Fixed	$212,000 – $1,060,000	$1,058,000 – $3,525,000	$3,750,000-$4,000,000
	21%	21%	21%
Variable	$700,000 – $3,500,000	$3,490,000 – $11,600,000	$12,300,000-$13,000,000
	69%	69%	69%
Production	750,000 – 4,200,000 lb/yr	4,200,000 – 12,000,000 lb/year	13,750,000 lb/year
	3,000 – 16,000 lb/day	17,000 – 50,000 lb/day	55,000 lb/year
Employment	30 – 150	150 – 450	500
Work Week	5 day/wk, 1 shift	5 day/wk, 1 shift	5 Day/Week 1 Shift
Water Use	14.5 – 77.3 MGPY	82 – 242 MGPY	190 MGPY
	0.04 – 0.22 MGPD	0.23 – 0.69 MGPD	0.76 MGPD
	13.8 gal/lb	13.8 gal/lb	13.8 gal/lb

TABLE 1-13

BROAD WOVEN FABRICS – DYEING AND FINISHING

	No. Employees (000's)	Payroll ($MM)	Value Added ($MM)	Cost of Materials ($MM)	Value of Shipments ($MM)	Capital Expenditures ($MM)	Total Plants
Cotton finishing plants: ratio of concentration, 1967: 4 large, 42%; 8 large, 59%							
1958	49.2	189.9	289.1	399.1	686.2	15.7	
1970	28.9	180.1	252.7	304.2	603.0	22.9	216
Synthetics finishing plants: ratio of concentration, 1967: 4 large, 37%; 8 large, 49%							
1958	16.2	74.3	114.8	95.3	210.7	3.6	
1970	33.8	220.4	429.0	608.9	1,011.6	29.3	233

Source: Annual Survey of Manufacturers, 1970

- Synthetic Finishing: In synthetic finishing, there is a similar pattern, where plants with up to 50 employees accounted for 50% of all establishments, or 115.

We estimate that 110 mills have gone out of business since the 1967 Census. Of the remainder, 34 large integrated mills with more than 500 employees, according to the contractor's criteria, will not be impacted.

In addition, we estimate that 80 mills are integrated and will not be impacted.

Of the remaining 225 mills, we estimate that 80 are small mills that discharge to municipal treatment plants; 90% of the remainder, or 131, are commission finishers, and 10%, or 14, are mills that do not qualify under the definition of commission finishers.

Using the same ratio of mill sizes as given in the 1967 Census, we note that 131 commission mills are divided into 81 small mills with less than 250 employees, and 50 medium-size mills with from 250 to 500 employees. This categorization is depicted in Figure 1-3.

(c) Number of Employees. We estimate the number of employees in this category to be 56,200. Those employees potentially impacted, based on the average employment in the representative mills, are listed in Table 1-15.

TABLE 1-14

WOVEN FABRICS

(Dyeing and Finishing Establishments)

1967

	Number of Establishments	Number of Employees (000's)
Finishing plants — cotton:		
Total establishments	216	35.7
Establishments with an average of employees:		
1 to 4	42	0.1
5 to 9	13	0.1
10 to 19	25	0.4
20 to 49	42	1.4
50 to 99	29	2.0
100 to 249	26	4.6
250 to 499	15	5.6
500 to 999	21	21.6
1,000 to 2,499	1	—
2,500 or more	2	—
Finishing plants — synthetics:		
Total establishments	233	25.7
Establishments with an average of employees:		
1 to 4	21	—
5 to 9	14	0.1
10 to 19	31	0.5
20 to 49	49	1.7
50 to 99	47	3.5
100 to 249	44	7.1
250 to 499	17	5.8
500 to 999	9	7.0
1,000 to 2,499	1	—
2,500 or more	—	—

Source: Census of Manufactures, 1967

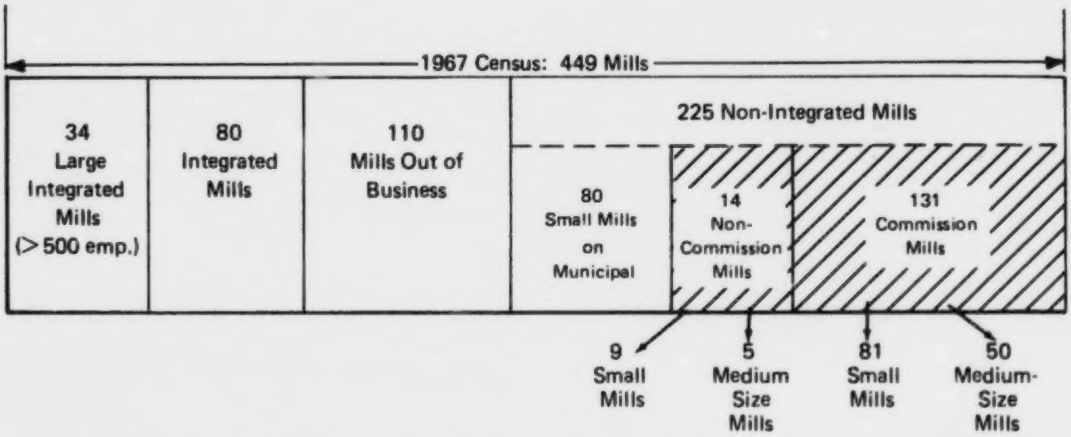
1967 Census: 449 Mills
34
Large
Integrated
Mills
(> 500 emp.)
80
Integrated
Mills
110
Mills Out of
Business
225 Non-Integrated Mills
80
Small Mills
on
Municipal
14
Non-
Commission
Mills
131
Commission
Mills
9
Small
Mills
5
Medium
Size
Mills
81
Small
Mills
50
Medium-
Size
Mills

FIGURE 1-3 NUMBER OF ESTABLISHMENTS: CATEGORY 4 – BROAD WOVEN FABRICS – DYEING AND FINISHING

TABLE 1-15

NUMBER OF EMPLOYEES: CATEGORY 4 – BROAD WOVEN FABRIC DYEING AND FINISHING

		No. of Employees
131 Commission Mills		28,500
Composed of 81 small mills:	6,000	
50 medium mills:	22,500	
208 Non-Commission Mills		27,700
Composed of 9 small mills:	675	
5 medium mills:	2,250	
194 other mills not exposed:	24,775	

(d) Type of Plants. Types of plants vary greatly, depending on the size, and the types of products they process, since the industry is engaged in bleaching, printing, dyeing, and finishing. The smaller plants with no more than 50 employees, in most cases, have old equipment that has not been modernized due to lack of capital resources. The larger plants, both independent and those that are part of weaving complexes, are modern and efficient.

(e) Geographic Distribution. Tables 1-16 and 1-17 illustrate the geographic distribution of the industry. In cotton finishing plants the northeastern region accounted for the majority of establishments, mostly composed of the 125 out of 216 establishments. In the southern region, where most of the large integrated establishments are located, there are

67 establishments. The synthetic finishing plants show a similar pattern, where the northeastern region represents over 50%, or 177 plants, and the southern region 46 plants of a total 233.

TABLE 1-16

WOVEN FABRICS – COTTON DYEING AND FINISHING
(Geographic Distribution)

	No. of Establishments	With 20 or More Employees
Finishing Plants – Cotton:		
United States	216	136
Northeastern Regin	125	70
New England Division	37	27
New Hampshire	2	2
Massachusetts	15	11
Rhode Island	15	9
Connecticut	5	5
Middle Atlantic Division	88	43
New York	44	19
New Jersey	25	16
Pennsylvania	19	8
North Central Region	18	6
East North Central Division	14	4
Illinois	9	3
Southern Region	67	59
South Atlantic Division	54	49
Delaware	1	1
Maryland	3	3
Virginia	2	2
North Carolina	18	18
South Carolina	17	17
Georgia	10	6
East South Central Division	8	7
Tennessee	3	2
Alabama	3	3
West South Central Division	5	3
Arkansas	1	1
Oklahoma	1	1

Sources: Census of Manufactures, 1967, ADL estimates and industry listings.

TABLE 1-17

WOVEN FABRICS – SYNTHETIC DYEING AND FINISHING*
(Geographic Distribution)

Finishing Plants – Synthetics:	No. of Establishments	With 20 or More Employees
United States	233	167
Northeastern Region	177	124
New England Division	43	35
New Hampshire	1	1
Massachusetts	20	16
Rhode Island	9	8
Connecticut	13	10
Middle Atlantic Division	134	89
New York	58	28
New Jersey	67	54
Pennsylvania	9	7
Southern Region	46	39
South Atlantic Division	45	38
Virginia	5	5
North Carolina	24	21
South Carolina	10	9
Georgia	2	1
East South Central Division	1	1
Tennessee	1	1
West Region	6	2
Pacific Division	5	2
California	5	2

Sources: Census of Manufactures, 1967, ADL estimates and industry listings.

*The subtotals do not add up to totals, in all cases, since all geographical areas are not necessarily included.

(f) Level of Integration. There are basically two types of establishments:

(a) Those owned by large weaving mills: These are separate dyeing and finishing companies owned by large textile corporations, such as Burlington, Stevens, and Deering Milliken, which might within a single corporate complex own up to four finishing plants. We estimate that out of a total of 449 establishments approximately 114 are integrated. However, value of shipments of these establishments accounted for an estimated 50 to 60% of the total dyeing and finishing industry.

(b) Commission dyers and finishers: We estimate that 211 of a total of 449 are independent commission dyers and finishers without corporate relationship to weaving mills. Their sole function is to commission-finish woven goods, supplying such services as bleaching, dyeing, printing, and finishing.

(g) Types of Products. Both the synthetic and cotton fabric finishing industries are engaged in processing the following products:

- Bleaching operation – the major volume is household domestics, including sheets and pillowcases;
- Dyeing, plain colors – a conversion of greige woven goods into dyed fabric for both apparel and household products;
- Printing – a conversion of woven greige goods into printed fabrics; and
- Special finishing – includes all processes after dyeing to impart special effects to fabrics, such as heat setting, water repellency, or other finishes.

(h) Financial Structure. Commission dye houses charge about $0.37 per pound for dyeing and finishing broadwoven fabrics, and $0.70 per pound for printing and other specialties. No published financial structure for independent dyeing and finishing establishments is available. We have therefore included financial data relating to large textile companies which own facilities for dyeing and finishing their own fabrics, or provide commission dyeing and finishing services (Table 1-18).

(i) Composite Mill. The following examples are for mills that do commission dyeing and finishing only. Those that do spinning and weaving as well will show a higher profit from the contribution of the dry processing, and the sales volume per pound of goods produced will increase by a factor of about 3.5. Therefore, they will be in better shape to handle waste treatment costs. Table 1-19 presents typical ranges of the various business facets of representative mills involved in Category 4 operations.

(4) Category 5 – Knitted Fabric – Dyeing and Finishing (Cotton and Synthetics)

(a) General. Census figures are available for mills that perform dyeing and finishing only (commission dyers) and for total knit mills which include both "knitting only," as well as commission finishers and integrated establishments that have both knitting, dyeing, and finishing. We have therefore estimated the breakdown between integrated finishing mills and those mills that do knitting only.

TABLE 1-18

FINANCIAL PROFILE

(Integrated Textile Mills with Dyeing and Finishing Facilities)

	Burlington Industries	J.P. Stevens	Merchants	Lowenstein	West Point Pepperell	Springs	Cannon Mills	Cone	Dan River	Fieldcrest
Net Sales ($MM)										
1970	1,822	893	708	387	374	308	306	298	293	212
1971	1,727	861	738	444	355	326	323	319	312	227
Net Profit ($MM)										
1970	71.4	6.3	17.4	8.3	8.7	6.2	15.6	4.8	(1.0)	7.8
1971	40.1	(0.6)	16.4	8.9	6.2	8.4	16.8	7.0	(2.6)	7.9
Profit Margin										
1970	3.9%	0.7%	2.5%	2.1%	2.3%	2.0%	5.1%	1.6%	–%	3.7%
1971	2.3%	–%	2.2%	2.0%	1.8%	2.6%	5.2%	2.2%	–%	3.5%
Return on Equity										
1970	10%	2%	7%	6%	5%	3%	7%	4%	–	10%
1971	5%	–%	6%	6%	3%	3%	7%	5%	–	10%
Return on Investment										
1970	6%	1%	4%	5%	5%	2%	7%	3%	–	6%
1971	4%	–%	4%	4%	3%	3%	7%	4%	–	6%
Capital Expenditures ($MM)										
1970	123	28	22	19	12	15	15	11	8	7
1971	104	30	16	25	10	17	12	12	10	7

Source: Based on Annual Reports

TABLE 1-19

REPRESENTATIVE BROAD WOVEN DYEING AND FINISHING MILLS – CATEGORY 4

	Small	Medium	Large
Sales	$1,060,000-$2,120,000	$8,480,000-$15,900,000	$16,700,000
Profit (before taxes)	$0-$127,200 0-6%	$0-$954,000 0-6%	$0-$1,000,000 0-6%
Profit (after taxes)	$0-72,600 0-3.4%	$0-$502,600 0-3.2%	$0-$530,000 0-3.2%
Depreciation	$74,200-$148,400	$593,600-$1,113,000	$1,170,000
Debt Repayment	Not Known	Not Known	Not Known
Cash Flow	$74,200-$221,000	$593,600-$1,615,600	$1,170,000-$1,700,000
Salvage Value	$265,000-$530,000	$2,120,000-$3,975,000	$4,175,000
Cost Structure			
Fixed	$400,000-$752,000 38%	$3,222,000-$5,640,000 38%	$6,300,000-$6,000,000 38%
Variable	$660,000-$1,240,800 62%	$5,258,000-$9,306,000 62%	$10,400,000-$9,700,000 62%
Production	1,500,000-3,000,000 lb/yr 6,000-12,000 lb/day	12,500,000-23,800,000 lb/yr 50,000-95,000 lb/day	25,000,000 lb/yr 100,000 lb/day
Employment	50-100	300-600	625
Work Week	5-6 days, 2-3 Shifts	5-6 days, 2-3 shifts	5-6 days, 2-3 shifts
Water Use	37.8-75.6 MGY 6.1-6.2 MGD 18.0 gal/lb	315 MGY 0.9-1.71 MGD 18.0 gal/lb	450 MGY 1.8 MGD 18.0 gal/lb

According to the Census of Manufactures 1967, some 541 mills were engaged in the manufacture of knitted fabrics, including dyeing and finishing.

Table 1-20 illustrates the relative position of the industry between 1958 and 1970. Employment rose sharply from 18,000 in 1958 to 48,000 in 1970. A similar relationship is reflected in the value of shipments and capital expenditures. This relates directly to the fact that knitted fabrics have been the fastest growing segment of the textile industry in the United States between 1958 and 1970.

(b) Size Distribution. Table 1-21 illustrates the size distribution of knit fabric mills and also illustrates the nature of the industry, which is highly fragmented with small plants being the dominant factor. Plants with under 50 employees per establishment accounted for a total of 371 establishments out of 541.

Some 331 of these mills knit and dry-finish the fabric without dyeing and finishing and are classified as greige goods mills.

One-hundred and twenty of the remaining mills in this category are integrated mills that knit, dye, and finish fabric, and they are considered not to be significantly impacted by implementation of the guidelines. Of the remainder, we estimate that 10 mills have gone out of business since the 1967 Census.

TABLE 1-20

DYEING AND FINISHING – KNITTED FABRICS
INDUSTRY GROWTH 1958-1970

	No. Employees					
	No. (000)	Payroll ($MM)	Value Added ($MM)	Cost of Materials ($MM)	Value of Shipments ($MM)	Capital Expenditures ($MM)
1970	48.2	296.2	648.5	1,235.9	1,881.8	85.3
1958	18.4	73.9	147.4	336.1	487.2	7.1

Source: Annual Survey of Manufacturers, Dept. of Commerce

TABLE 1-21

KNITTED FABRICS MANUFACTURERS – DYEING AND FINISHING
(Size Distribution)

	No. of Establishments	No. of Employees (000's)
Total establishments	541	36.3
Establishments with an average of		
1 to 4 employees	95	.2
5 to 9 employees	59	.4
10 to 19 employees	93	1.3
20 to 49 employees	124	4.0
50 to 99 employees	63	4.6
100 to 249 employees	75	11.7
250 to 499 employees	23	7.7
500 to 999 employees	8	6.4
1,000 to 2,499 employees	1	—

Source: 1967 Census of Manufactures

Of the 80 non-integrated mills left, we estimate that 4 are non-commission mills (by the definition of commission mills used in this study) and 76 are commission mills.

Of the four non-commission mills, we estimate that three are small mills and one is medium-sized. Of the 76 commission mills, we estimate that 62 are small and 14 medium size. These categorizations are shown in Figure 1-4.

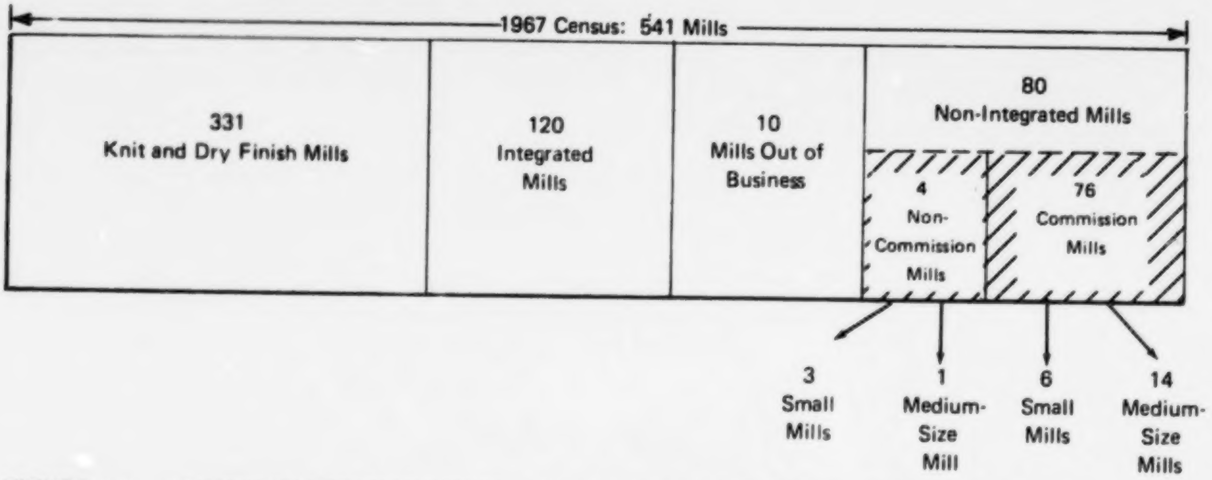
1967 Census: 541 Mills
331
Knit and Dry Finish Mills
120
Integrated
Mills
10
Mills Out of
Business
80
Non-Integrated Mills
4
Non-
Commission
Mills
76
Commission
Mills
3
Small
Mills
1
Medium-
Size
Mill
6
Small
Mills
14
Medium-
Size
Mills

FIGURE 1-4 NUMBER OF ESTABLISHMENTS: CATEGORY 5 – KNIT FABRIC – DYEING AND FINISHING

(c) Number of Employees. The number of employees in this category and those potentially impacted, based on the average employment in the representative mills, are shown in Table 1-22.

TABLE 1-22

NUMBER OF EMPLOYEES: CATEGORY 5
KNITTED FABRICS – DYEING AND FINISHING

		No. of Employees
76 Commission mills –		3,900
Composed of 62 small mills:	2,500	
and 14 medium mills:	1,400	
4 Non-commission, non-integrated mills –		320
Composed of 3 small mills:	220	
and 1 medium mill:	100	
451 other mills in this category:		30,180
Total		34,400

(d) Types of Plants. The knitted fabric industry emerged in the United States in 1960. Therefore, most equipment on hand is relatively new. The age of plants in most cases varies from 15 to 5 years.

The level of technology is good and efficiency is excellent in the larger mills, and below average in the small and fragmented ones.

(e) Geographic Distribution. Table 1-23 shows the geographic distribution of the knitting industry with the northeastern region accounting for 398, or 74% of the mills, mostly in the Middle Atlantic section, with employment of 21,000. In the South there are 124 plants, mostly the large integrated mills, employing 14,000.

Table 1-24 gives the geographic distribution of mills engaged in dyeing and finishing in 1967. Of the total there were only 80 establishments, 63% of which were located in the Northeast, mostly the Middle Atlantic section, where there were 44 plants. The southern region accounts for 22 establishments, or 28% of the total. The current estimate of the number of mills is 90, and the geographic distribution has not changed significantly.

TABLE 1-23

GEOGRAPHIC DISTRIBUTION OF KNITTED FABRIC MANUFACTURERS INCLUDING DYEING AND FINISHING*

	No. of Establishments	No. of Employees (000's)
United States	541	36.3
Northeastern Region	398	21.2
New England Division	43	6.0
Massachusetts	17	3.7
Rhode Island	12	1.0–2.5 est.
Connecticut	11	.4
Middle Atlantic Division	355	15.1
New York	233	6.8
New Jersey	60	2.8
Pennsylvania	72	5.6
North Central Region	12	.6
East North Central Division	7	.5–1.0 est.
Wisconsin	7	.5–1.0 est.
Southern Region	124	14.3
South Atlantic Division	113	12.3
Virginia	6	1.0
North Carolina	86	9.0
South Carolina	14	1.7
Georgia	5	.5–1.0 est.
East South Central Division	11	2.0
Tennessee	5	1.0–2.5 est.
Alabama	4	.4
Western Region	7	.2
Pacific Division	7	.2
California	7	.2

Sources: 1967 Census of Manufactures, ADL estimates and industry listings.

*The subtotals do not add up to totals, in all cases, since all geographic areas are not necessarily included.

TABLE 1-24

GEOGRAPHIC DISTRIBUTION OF KNITTED FABRIC DYERS AND FINISHERS ONLY*

	No. of Establishments			
United States	80			
Northeastern Region		50		
New England Division			6	
Massachusetts				3
Rhode Island				1
Connecticut				1
Vermont				1
Middle Atlantic Division			44	
New York				24
New Jersey				12
Pennsylvania				8
Southern Region		22		
South Atlantic Division			14	
Virginia				2
North Carolina				10
South Carolina				2
East South Central Division			2	
Tennessee				1
Florida				1
Unaccounted for				8

Sources: Census of Manufactures 1967, ADL estimates and industry listings.

*The subtotals do not add up to totals, in all cases, since all geographic areas are not necessarily included.

(f) Level of Integration. The level of integration in the knitted fabric industry can be divided into the following segments:

(a) Knitting mills engaged primarily in knitting and dry finishing (331 establishments). They purchase dyed yarn from outside sources and it is knitted on premises and dry-finished, or they purchase greige yarn that they knit on their own premises and have it commission dyed and finished by outside sources.

(b) Integrated knitting mills (120 establishments). These are the large knitwear producers of both warp and circular knit fabrics which, in addition to knitting, have yarn-dyeing facilities and piece-dyeing facilities. In most cases these mills dye and finish their total fabric requirements. In some cases, they also act as commission dyers and finishers for other parties.

(c) Knit goods fabric commission dyers and finishers (80 establishments). These are firms which predominantly work on a commission basis, performing a service for knitting mills that do not have their own dyeing and finishing facilities.

(g) Type of Products. The knitted fabric industry basically produces three types of products:

- Warp knit fabrics, both yarn and piece-dyed, composed of tricot and raschel types that predominantly utilize three raw materials – filament acetate, and filament polyester. Sixteen of the largest mills accounted for 60% of the total productive capacity.
- Double-knit fabrics, both yarn and piece dyed, which utilize predominantly polyester filament yarns and, to a lesser degree, nylon, acrylics, and cotton, and predominantly produce fabrics for the apparel trade. Twenty-eight of the largest mills accounted for 50% of total productive capacity.
- Single-knit fabrics, utilizing cotton, acrylics, polyester filament yarn and piece dyed, for the apparel trades. Thirteen of the largest mills accounted for 40% of total productive capacity.

(h) Financial Profile. Table 1-25 represents the financial structure of the largest integrated knitting mills having their own dyeing and finishing facilities. Table 1-26 represents financial profiles of the largest independent commission finishers for knitted fabrics.

(i) Composite Mill. The composite small and medium mills are commission dyers and finishers. Because the average age of the equipment is much lower than in the other finishing categories, knit finishing operations have higher salvage and depreciation levels.

An increasing number of knit finishers are involved in knitting, along with dyeing and finishing. Their sales dollar per pound of product will be about twice as high as that of commission dyers. The profit for the dry operations is 1 or 2% (after taxes) higher than for dyeing and finishing.

TABLE 1-25

FINANCIAL PROFILE – PROFIT MARGIN OF INTEGRATED KNITTING MILLS

1970-1971

	Texfi Industries	Guilford Mills, Inc.	Stevecoknit	Edmos Corp	Scottex Corp
Net Sales ($MM)					
1970	97	43	27	25	15
1971	164	53	33	32	24
Net Profit ($MM)					
1970	5.3	0.7	1.6	1.8	0.8
1971	11.3	2.7	2.4	2.5	1.1
Profit Margin					
1970	5.5%	1.6%	5.9%	7.2%	5.3%
1971	6.9%	5.1%	7.3%	7.8%	4.6%
Return on Equity-Return on Investment					
1970	18% 12%	10% 6%	44% 25%	22% 17%	29% 13%
1971	25% 16%	37% 25%	27% 21%	14% 12%	11% 7%

Source: Based on Company Annual Reports

TABLE 1-26

FINANCIAL PROFILE – PROFIT MARGIN OF THE LARGEST COMMISSION DYERS OF KNITTED FABRIC (1969-1971)

	1969	1970	1971
United Piece Dye Works, Inc.:			
Net Sales ($MM)	28	28	30
Net Profit ($MM)	2.1	2.6	3.9
Profit Margin	7.5%	9.1%	13.2%
Return on Equity-Return on Investment	21% 15%	21% 17%	26% 23%
Capital Expenditures ($MM)	2	2	2

Source: Based on Company Annual Reports.

Some mills in this category buy their own yarn, knit it, and then dye and finish the knitted fabric. In these mills, the sales dollar per pound of product will be about five times what the commission dyers charge. As in the case of the knitter/finisher described above, the profit level will be higher since the dry operations are more profitable than dyeing and finishing.

Note that employees are hourly employees and salvage value is for equipment only.

Table 1-27 presents typical ranges of the various business facets of representative mills involved in Category 5 operations.

A large percentage of the equipment found in knitting and knit finishing mills is relatively new. The higher temperatures needed for dyeing polyester with disperse dyes and the need to handle knits much more gently than woven piece goods have required new equipment designs: principally, the pressure jet beck. As a result, combined with the low profit level, depreciation is a major contributor to cash flow.

The composite mill is presented as a commission dye house, which should be more severely impacted than an integrated mill, since it cannot carry dye house losses or overhead by the more profitable dry operations.

Table 1-28 illustrates the relative position of the industry between 1958 and 1970. Employment rose sharply from 18,000 in 1958 to 48,000 in 1970. A similar relationship is reflected in the value of shipments and capital expenditures. This relates directly to the fact that knitted fabrics have been the fastest growing segment of the textile industry in the United States between 1958 and 1970.

(5) Category 7 – Yarn and Stock – Dyeing and Finishing

(a) General. According to the Census of Manufactures, during 1967 a total of 192 establishments were engaged in the dyeing and finishing of yarn, stock, and narrow fabrics. Yarn dyeing facilities accounted for the bulk of these establishments, estimated at 80% of the total.

Table 1-29 illustrates the relative position of yarn dyeing facilities between 1958 and 1970. During that period, employment increased from 7,800 to 12,300, and value of shipments doubled, and capital expenditures rose from $2.1 million to $13.3 million.

TABLE 1-27

REPRESENTATIVE KNIT FABRIC DYEING AND FINISHING MILLS – CATEGORY 5

	Small	Medium	Large
Sales	1,605,000 – $3,210,000	$5,082,500 – $8,560,000	$13,700,000
Profit (before taxes)	$0 – $160,500	$203,300 – $1,027,200	$548,000-$1,640,000
	0 – 5%	0 – 12%	4-12%
Profit (after taxes)	$0 – $90,000	$112,200 – $540,600	$290,000-$865,000
	0 – 2.8%	2.2 – 6.3%	2.1%-6.3%
Depreciation	$160,500 – $321,000	$508,250 – $856,000	$1,300,000
Debt Repayment	$64,200 – $128,400	$203,300 – $342,400	$550,000
Cash Flow	$96,300 – 282,600	$417,200 – $1,054,200	$1,590,000-$2,165,000
Salvage Value	$529,650 – $1,059,300	$1,677,200 – $2,824,800	$4,570,00
Cost Structure			
Fixed	$450,000 – $855,000	$1,368,000 – $2,112,000	$3,550,000-$3,700,000
	28%	27 – 28%	27-28%
Variable	$1,155,000 – $2,194,500	$3,511,200 – $5,420,800	$9,600,000-$9,500,000
	72%	73 – 72%	73-72%
Production	3,000,000 – 6,000,000 lb/yr	9,500,000 – 16,000,000 lb/yr	25,600,000 lb/yr
	10,000 – 20,000 lb/day	30,000 – 50,000 lb/day	80,000 lb/day
Employees	25 – 50	75 – 125	200
Work Week	5-6 day, 3 shifts	5-6 day, 3 shifts	5-6 days, 3 shifts
Water Use	70 – 140 MGY	210 – 350 MGY	512 MGY
	0.2 – 0.4 MGD	0.6 – 1.0 MGD	1.6 MGD
	20 gal./lb	20 gal./lb	20 gal/lb

TABLE 1-28

DYEING AND FINISHING – KNITTED FABRICS INDUSTRY GROWTH 1958-1970

	No. Employees No. (000)	No. Employees Payroll ($MM)	Value Added ($MM)	Cost of Materials ($MM)	Value of Shipments ($MM)	Capital Expenditures ($MM)
1970	48.2	296.2	648.5	1,235.9	1,881.8	85.3
1958	18.4	73.9	147.4	336.1	487.2	7.1

Source: Annual Survey of Manufacturers, Dept. of Commerce.

TABLE 1-29

YARN AND STOCK DYEING AND FINISHING INDUSTRY GROWTH 1958-1970

	No. Employees (000's)	Payroll ($MM)	Value Added ($MM)	Cost of Materials ($MM)	Value of Shipments ($MM)	Capital Expenditures ($MM)
Finishing Plants – Yarn: Ratio of concentration, 1967: 4 large, 29%; 8 large, 44%						
1958	7.8	28.8	52.0	105.7	158.0	2.1
1970	12.3	72.9	141.9	206.5	346.3	13.3

Total Plants: 192

Source: Annual Survey of Manufacturers 1970.

(b) Number of Establishments and Size Distribution. According to the 1967 Census of Manufactures, 192 establishments were engaged in the dyeing and finishing of yarn, stock, and narrow fabrics. The Census breakdown by size is given in Table 1-30.

Of these 192 mills, 102 are integrated mills which we assumed would not be impacted by compliance with the guidelines.

The remaining 90 mills are non-integrated, and we assumed them to be prone to impact.

Of these 90 mills, we estimated that 26 were non-commission mills by the definition of commission mills used in this study. These 26 mills are estimated to be composed of 22 small mills and 4 medium mills, based on the 1967 Census ratio of mills employing 50 to 100 compared to those mills employing less than 50.

TABLE 1-30

YARN AND STOCK DYEING AND FINISHING

Establishments

	No. of Establishments	No. of Employees (000's)
Finishing Own Yarns:		
Total Establishments	129	8.2
Establishments with an average of:		
1 to 4 employees	29	0.1
5 to 9 employees	13	0.1
10 to 19 employees	21	0.3
20 to 49 employees	22	0.7
50 to 99 employees	23	1.7
100 to 249 employees	14	2.1
250 to 449 employees	4	1.3
500 to 999 employees	3	1.9
Commission Finishing – yarn:		
Total Establishments	63	4.2
Establishments with an average of:		
1 to 4 employees	9	–
5 to 9 employees	11	0.1
10 to 19 employees	4	0.1
20 to 49 employees	18	0.6
50 to 99 employees	9	0.6
100 to 249 employees	6	1.0
250 to 449 employees	6	1.9

Source: Census of Manufactures, 1967

We estimated that the remaining 64 commission mills were composed of 53 small mills and 11 medium-sized mills, again using the Census ratio. The above distribution of mills is shown in Figure 1-5.

(c) Number of Employees. The number of employees in this category, and those potentially impacted, based on the average employment in the representative mills, are shown in Table 1-31.

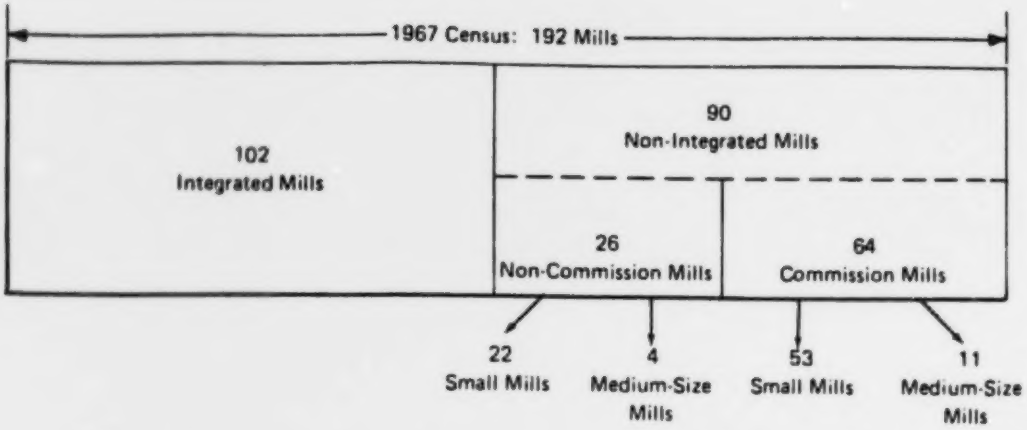
1967 Census: 192 Mills
102
Integrated Mills
90
Non-Integrated Mills
26
Non-Commission Mills
64
Commission Mills
22
Small Mills
4
Medium-Size Mills
53
Small Mills
11
Medium-Size Mills

FIGURE 1-5 NUMBER OF ESTABLISHMENTS: CATEGORY 7 – STOCK AND YARN DYEING AND FINISHING

TABLE 1-31

NUMBER OF EMPLOYEES: CATEGORY 7 – STOCK AND YARN DYEING AND FINISHING

		No. of Employees
64 Commission mills		1,860
Composed of 53 small mills:	1,200	
and 11 medium mills:	660	
128 Non-commission mills		8,300
Composed of 22 small mills:	500	
4 medium mills:	240	
102 integrated mills:	7,560	
Total		10,160

(d) Types of Plants. As we have illustrated in Table 1-29, major capital investment has occurred in the last 10 years, which is reflected in the relatively modern equipment in the establishments that are of large size. Small establishments are fragmented and equipment is not up to date.

(e) Geographic Distribution. Table 1-32 gives the geographic distribution of yarn finishing plants. Of a total of 192 plants in the United States the majority is in the northeastern region, where there are 121 plants or two-thirds of the total, and 57 plants or one-third are located in the southern region.

(f) Level of Integration. The level of integration between integrated yarn dyers and independent commission yarn dyers is presented below.

TABLE 1-32

YARN AND STOCK DYEING AND FINISHING*
(Geographic Distribution)

	No. of Establishments				With 20 or More Employees			
Finishing Plants – Yarn:								
United States	192				105			
Northeastern Region		121				53		
New England Division			18				13	
Massachusetts				10				8
Rhode Island				7				5
Middle Atlantic Division			103				40	
New York				42				14
New Jersey				39				15
Pennsylvania				22				11
North Central Region		7				4		
East North Central Division			6				4	
Ohio				1				1
Illinois				2				1
Michigan				1				1
Wisconsin				2				1
Southern Region		57				45		
South Atlantic Division			46				39	
Virginia				2				2
North Carolina				35				29
South Carolina				4				3
Georgia				4				4
East South Central Division			10				6	
Tennessee				7				4
Alabama				3		3		2
Western Region		7					3	
Pacific Division			7					3
California				7				

Sources: Census of Manufactures 1967, ADL estimates and industry listings.

*The subtotals do not add up to the totals, in all cases, since all geographic areas are not necessarily included.

(1) Integrated Yarn Dyers. Integrated yarn dyers are composed of two distinct types:

(a) Divisions of the large integrated weaving mills that own their own spinning and texturizing facilities and utilize their own yarn-dyeing facilities to finish the output of their spinning and texturizing mills. Dyed yarn is then sold to outside customers or used internally.

(b) Independent yarn spinners and texturizers that have their own dyeing facilities and produce yarn only, which in turn is dyed in their own facilities and sold outside.

In both cases, the dyeing facility could be used to do commission dyeing for outside customers in addition to its own requirements.

We estimate that out of our total of 192 establishments, 102 are parts of independent yarn producers or integrated textile companies.

(2) Commission Yarn Dyers. Commission yarn dyers are independent plants that perform a service function only. The larger ones purchase yarn and sell dyed yarns to their customers; the smaller ones simply perform the function of commission dyeing.

We estimate that out of a total of 192 establishments, 80 to 90 are independent yarn dyers; this would also account for the discrepancy in ratios illustrated, according to the Census of Manufactures, in Table 1-33.

TABLE 1-33

FINISHING PLANTS, YARN AND STOCK

(Size Distribution by Number of Employees)

	No. of Establishments	No. of Employees (000's)
Finishing Own Yarns:	129	8.2
Commission Finishing:	63	4.2

Source: Census of Manufactures 1967

(g) Types of Products. The dyeing of stock and yarn is a limited, specialized operation, solely limited to imparting color to both filament and staple yarns, predominantly in cotton and synthetic fibers.

(h) Financial Profile. No financial structure for independent commission yarn dyers is available. We therefore feel that representative financial structures are expressed in the category of integrated yarn manufacturing and dyeing as illustrated in Table 1-34.

TABLE 1-34

FINANCIAL PROFILE

(Yarn Spinning and Dyeing)

	Dixie Yarns	National Spinning Company	Standard Coosa-Thatcher	Burkyarns Inc.
Net Sales ($MM)				
1970	87	75	50	17
1971	99	76	53	22
Net Profit ($MM)				
1970	1.7	2.1	1.9	0.9
1971	2.3	1.9	1.7	1.3
Profit Margin				
1970	2.0%	2.8%	3.8%	5.3%
1971	2.3%	2.5%	3.2%	5.9%
Return on Equity				
1970	6%	9%	7%	25%
1971	7%	8%	6%	24%
Return on Investment				
1970	5%	9%	6%	15%
1971	7%	8%	5%	15%
Capital Expenditures ($MM)				
1970	3	4	3	3
1971	–	2	6	2

Source: Based on Company Annual Reports

As illustrated in Table 1-35, a major capital investment has occurred in the last 10 years, which is reflected in the relatively modern equipment in the larger establishments. Small mills are fragmented and equipment is not up to date.

TABLE 1-35

YARN AND STOCK DYEING AND FINISHING INDUSTRY GROWTH 1958-1970

	No. Employees (000)	Payroll ($MM)	Value Added ($MM)	Cost of Materials ($MM)	Value of Shipments ($MM)	Capital Expenditures ($MM)
Finishing Plants – Yarn: Ratio of concentration, 1967: 4 large, 29%; 8 large, 44%						
1958	7.8	28.8	52.0	105.7	158.0	2.1
1970	12.3	72.9	141.9	206.5	346.3	13.3

Source: Annual Survey of Manufacturers 1970.

Most dyed yarns are used in woven fancy piece goods, Jacquard knits, and carpets, which constitute a strong segment of the current textile market.

Stock-dyed fiber is losing importance. Stock dyeing was used to obtain yarns containing fibers of different shades; i.e., blended from different stock fibers. Use of newly developed specific cationic dyes provides a similar effect in single-bath piece dyeing (after weaving or knitting) at a lower production cost and provides a rapid turnaround of inventories and quickened delivery to the customer.

(i) Composite Mill. A representative small mill dealing in this category might be a northern yard mill with some of its buildings dating from the late 1800's with newer sections built in the 1920's, and then modified in the 1950's. Some production equipment might be 30 years old with some pressure dye kettles being less than 5 years old. The average age of the equipment might range from 8 to 10 years.

A representative medium sized mill might be an urban-type mill located in one of the mid-Atlantic states. This mill would likely be a commission dye house which buys its own yarn, dyes it, and then sells it to its customers (formerly the customer owned the yarn). Thus the mill would have appreciable capital tied up in yarn inventory. The age of its equipment would vary considerably, as with the small mills, with some of its machines being 30 or more years old and some relatively new, since the medium sized mills generally have a regular capital improvement program.

The medium sized mill would likely process both synthetic and natural fibers, including wool, but it would not likely have space for treatment facilities. Any treatment required would have to be performed in some of its present production or warehouse space, as they may be space-limited. Table 1-36 presents typical ranges of the various business facets of the small- and medium-size mills involved in Category 7 operations, and of a large mill to help establish the level of 1983 treatment costs that may be able to be passed on.

TABLE 1-36

REPRESENTATIVE SMALL- AND MEDIUM-SIZE STOCK AND YARN DYEING MILLS

	Small	Medium	Large
Sales	$916,400 – $2,687,500	$2,687,500 – $5,375,000	$6,700,000
Profit (before taxes)	$0 – $134,400	$107,500 – $322,500	$270,000-$400,000
	0 – 5%	4 – 6%	4-6%
Profit (after taxes)	$0 – $76,400	$62,400 – $174,200	$147,000-$215,000
	0 – 2.8%	2.3 – 3.2%	2.2-3.2%
Depreciation	$64,000 – $138,100	$188,100 – $376,250	$470,000
Debt Repayment	Not Known	Not Known	Not Known
Cash Flow	$64,000 – $264,500	$250,500 – $550,500	$617,000-$685,000
Salvage	$229,100 – $671,900	$671,900 – $1,343,750	$1,700,000
Cost Structure			
Fixed	$202,500 – $593,750	$593,400 – $1,175,000	$1,500,000
	23%	23%	23%
Variable	$668,100 – $1,959,400	$1,986,600 – $3,877,500	$5,000,000
	77%	77%	77%
Production	1,705,000 – 5,000,000 lb/yr	5,000,000 – 10,000,000 lb/yr	12,480,000 lb/yr
	6,820 – 16,000 lb/day	16,000 – 32,000 lb/day	40,000 lb/day
Employment	20 – 40	40 – 80	100
Work Week	5 day, 3 shift	5-6 day, 3 shifts	5-6 day, 3 shifts
Water Use	52.5 – 123 MGY	52.5 – 246 MGY	275 MGY
	0.15 – 0.35 MGD	0.15 – 0.70 MGD	0.9 MGD
	22 gal/lb	22 gal/lb	22 gal/lb

2. ECONOMIC ANALYSIS

a. **Introduction.** In this study we have examined the economic impact on the textile industry of the effluent guidelines for:

- the best practicable technology (BPT),
- the best available technology (BAT), and
- new source performance standards (NSPS).

We divided the textile industry into seven categories for the purpose of establishing effluent guidelines. They are:

- Wool scouring,
- Wool dyeing and finishing,
- Greige goods mills,
- Woven fabrics dyeing and finishing (cotton and synthetics),
- Knit fabric dyeing and finishing (cotton and synthetics),
- Carpet mills, and
- Stock and yarn dyeing and finishing.

We then examined the economic impact of the guidelines for five of the above categories. They are:

- Wool scouring,
- Wool dyeing and finishing,
- Woven fabric dyeing and finishing (cotton and synthetics),
- Knit fabric dyeing and finishing (cotton and synthetics), and
- Stock and yarn dyeing and finishing.

We eliminated the other two categories – greige goods mills and carpet mills – from this initial study of the economic impact on the assumption that they would not be significantly impacted by the effluent guidelines.

Greige goods mills, by definition, are mills employing only dry processes, such as knitting and weaving. Weaving mills would likely have a slashing operation, but in a well managed mill the pollution load generated by this process would be negligible. Therefore, we found greige goods mills have no appreciable pollution load beyond the sanitary load and, in our judgment, they will be unaffected by the effluent guidelines for this industry.

Carpet mills have been set aside from this initial study on the basis that they, unlike any other category of the textile industry, can pass on treatment costs in the form of investment or operating costs to their customers. While the situation might change between now and 1983, we believe that the largely inelastic demand for this product and prevailing pricing practices will allow absorption of treatment costs in the pricing structure for large,

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medium, and small carpet mills. In addition, because of this situation, these mills offer attractive investments, so that capital should be available to enable them to continue operation while complying with the guidelines.

A final circumstance that will reduce the impact on the carpet industry is that well over 50% of the industry is located in Dalton, Georgia, and are connected to the municipal waste system where the personnel are experienced in handling carpet mill wastes.

In addition to setting aside two of the seven textile categories from this initial study, we have also set aside large integrated textile mills which will not be significantly impacted, generally because of their higher profit levels, larger size, and integrated production, as well as their ability to strongly influence price levels within the industry and hence pass on the cost of pollution control. It is generally felt that the small- and medium-size mills do not have the same freedom to increase prices as do the larger, integrated mills. It is then the small- and medium-size mills that must absorb these costs from profits rather than by passing on the cost to their customers.

Many of the larger, integrated mills have already established treatment facilities and/or are connected to municipal treatment systems and have already met or exceeded the requirements of the proposed best practicable technology. They have, in turn, already absorbed the cost and, if necessary, passed on this cost to their customers. Small- and medium-size mills, in general, service the aftermarket and thus lag behind the larger mills, and as the market and the pricing structure have already absorbed the costs for larger mills to control pollution, the small- and medium-size mills cannot increase their prices.

Since the impact of pollution control is already partially absorbed by the larger mills, and since they should not, for the most part, have difficulty in absorbing additional increments, either from higher profits and/or price increases, we set them aside so as to concentrate on the impact that will be felt by the small- and medium-size mills within each of the five categories studied.

b. Methodology. This study is divided into two parts. The first part discusses the economic impact that the proposed effluent guidelines may have upon the five categories. For each of the categories studied, we conducted personal interviews with operating mills which we used in conjunction with telephone interviews with operating mills and other industry sources, as well as the contractors' textile industry specialists.

The second part of the study consists of profiles of the five categories studied based upon published information, in-house information, and other readily available sources. Each category is profiled in terms of the number of mills, size distribution, type of product, financial status, type of plant, geographic distribution, and sector segments to be affected by the guidelines.

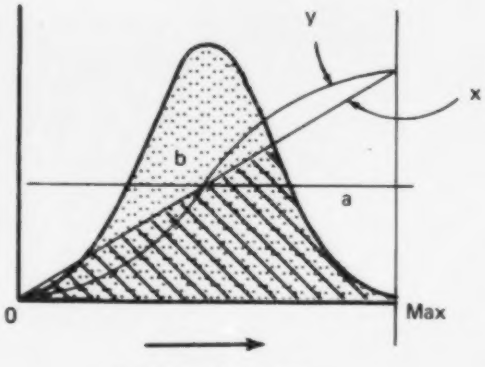
We then developed composites of different size mills believed to be representative of mills within each category. The dimensions of each composite mill are presented in terms of annual sales, profit, depreciation expense, cash flow, production, waste loads, water usage, and similarly related dimensions.

We then used each composite mill as the basis for calculating annual operating costs and investments necessary for pollution control within its category and mill size. For example, the waste load and water usage estimated for each composite mill is applied to the methodology of the Appendix to determine the operating costs and investment for each level of treatment.

c. **Mill Closings Criterion**. Having estimated the range of cash flows and other financial characteristics of a mill in each category and size classification studied, and further having established what the investment and operation costs would be for a mill operating within this range of financial characteristics, we subtracted the estimated annual operating cost from the range of annual positive cash flows. When the annual operating cost did not exceed the minimum cash flow thought to exist for that category, we then assumed that no plant closings would ensue as the result of meeting the effluent guidelines. Following this technique, if the annual operating cost should exceed cash flow for any particular mill example, then we would assume that all mills operating within this category and size classification would close. Continuing to use the zero cash flow criterion for a plant closing, we found that some plants within a certain category and size classification might close, since the operating cost of the treatment system would place them in a zero or negative cash position. To make an estimate of the percentage of mills within a category and size classification and in turn an estimate of the number of mills that will close, we assumed that the cash flow would be distributed linearly throughout the range described. If this assumption is made, then zero or negative cash flow would be proportional to the percentage of mills falling below the point where the annual operating cost would penetrate the cash flow range.

Had the data base been larger it might have been useful to assume a normal distribution of cash flows for each size mill rather than the linear distribution. Certainly in a statistical sense this would be a more elegant approach to determining the percentage of mills closing. For example, if we had reliable and accurate information about at least 30 mills in each size category, we could demonstrate whether or not the cash flows actually form a normal distribution. Since, for the most part, there are not that many mills in a size classification for a category, the demonstration of normalcy is not possible.

Using the simpler linear distribution the influence that it has upon the results can be envisioned by examining the figure. The area defined by "a" in the figure defines the linear distribution where it is equally probable that we will find a cash flow. The area defined by "b" is that of a normal distribution and would express the probability of finding a cash flow within a population obeying this distribution. The difference between these two assumptions can best be seen by comparing "line x" and "line y" which represent the cumulative probability for the linear and normal distributions. In our model it would make no difference whether a normal distribution and/or linear distribution were used at the halfway point. That is to say, both techniques would estimate the same percentage of mill closings.



Increasing Cash Flow

For cash flows below the mean we would find that the linear distribution tends to show a larger number of mill closings than does the normal distribution and, conversely, above the mean the normal distribution tends to increase the percentage of mill closings until finally at the end point where both distributions once again are equal. It does not appear that the slight overstatement of the linear distribution is particularly punitive, since it is to be expected that the firms with lower positive cash flows would be more inclined to close than those with higher cash flows, even if the distribution were normal. That is to say, even though the linear distribution tends to bias the percentage of mill closings below the 50% point, the contractor believes that this may be a more realistic expectation.

The use of a zero or negative cash flow as the criterion to determine plant closings tends to understate the number of mill closings if higher level criteria were to be used. Those higher level criteria would include profitability on sales, minimum rate of return on invested assets, internal rate of return, discounted cash flow method, or present value analysis. Each of these forms of analysis would likely carry with it a higher level of cash flow demand to satisfy the criterion, and hence would tend to increase the potential number of mill closings. We believe that since a large majority of the mills of small and medium size within the five categories studied are privately held companies or corporations, the zero or negative cash flow criterion most closely approximates the criteria actually (but perhaps never formally) applied to the decision of a mill closing.

There are an unknown number of mills which face imminent closing decisions and the necessity of meeting the proposed effluent guidelines, and the attendant investments and operating costs will merely hasten the final decision to close the mill rather than actually cause its closing, i.e., being the sole factor. There will undoubtedly be closings that will be ostensibly associated with the mills' inability to meet the investment and operating costs required by the proposed effluent guidelines. Based upon industry sources and interviews undertaken in support of this study, we estimate that as many as one-half of the mill closings which occur as a result of the proposed effluent guidelines will simply be accelerated closings, i.e., the mill would have closed spontaneously without the necessity of meeting the effluent guidelines.

We have presented the investments and annual operating costs against a background of how a mill would finance its new investments in waste treatment equipment. While an important criterion, which may in and of itself lead to mill closings, we have not used this as the closing criterion, but rather have selected the zero or negative cash flow as the criterion. We reason that far fewer mills will have great difficulty financing the investment than those which simply cannot afford the annual operating costs.

We have derived other impacts on employment and production directly from the estimated number of mill closings. We have treated tangential impacts, such as those relative to community pricing, financial and foreign trade, for the most part independently.

The impact on a specific mill and/or on a group of mills that form a slightly different composite can be estimated with material presented in the appendix of this study. This material permits estimates of the initial investment and annual operating costs for pollution control. The cash flow criterion for a mill closing or other criteria, such as profitability or rate of return on invested assets, can then be applied.

We assumed that the larger companies would pass on their treatment costs as a price increase, and that the small- and medium-size firms would benefit by incrementally greater revenues and thus ameliorate the impact that each would feel as a result of meeting the BAT guidelines.

Thus, if competitive conditions prevailing in 1983 permit large mills to pass on the incremental cost of BAT as a price increase, then the impact on small- and medium-size mills may be reduced as they too pass on a proportion of these costs. The proportion that the small- and medium-size mills may pass on is equal to the percentage price increase times their annual sales. The resulting increase in revenues may not cover all the incremental BAT costs for small- and medium-size mills and some may still be impacted and may even have to close.

Recognizing that the cost of treatment per pound for small- and medium-size mills may be greater than the cost of treatment by large mills, we have allowed the small- and medium-size mills to increase their revenues only by the amount equivalent to the cost of treatment by large mills. For example, if a large mill has a treatment cost of $0.003/lb, a small mill may have a treatment cost of $0.004/lb; the latter would be required to absorb $0.001/lb from its cash flow or other sources.

To complete the analysis we added the incremental revenue that would be generated by the price increase to the cash flows of each representative size mill. This would result in a new level of cash or funding available in 1983 to defray BAT treatment costs.

d. Waste Treatment Costs. The costs of alternate waste treatment methods to meet the guidelines have been calculated on the basis of initial capital investment and annual operating costs for each of the composite mills. The basis for these calculations are described in detail in Appendix A, and the results of this analysis are presented in Table 2-1.

We have calculated costs for best practicable technology waste treatment on the assumption that extended biological treatment will enable a mill to meet the guidelines for BOD, COD, and color.

Best practicable technology (BPT) for the textile industry, as suggested by the EPA, includes pretreatment of wastes (screening and 8-hour holdup) and subsequent municipal treatment, or alternatively, self-treatment by preliminary screening, primary settling (wool scouring only), coagulation (carpet mills only), and secondary biological treatment by extended aeration and stabilization ponds.

Pretreatment guidelines for discharge to a municipal treatment system are equivalent to BPT and BAT guidelines with regard to "incompatible" pollutants – COD, total chromium, sulfide, phenol, and oil and grease (the latter for wool scouring only).* The exception is where the municipal treatment plant is committed in its NPDES permit to remove a specified percentage of any incompatible pollutant, in which case the standard for the pollutant may be correspondingly reduced. Further, the Development Document** indicates that such incompatible pollutants may be reduced to acceptable limits by in-plant process changes. Therefore, for this economic analysis, we assumed that screening and an eight-hour holdup tank represented adequate pretreatment prior to discharge to the municipal waste water treatment plant.

Because of the low annual operating costs associated with the treatment described above, we further assumed that, on the basis of field visits, such pretreatment is presently being practiced by small- and medium-size mills that are connected to municipal systems. In addition, we assumed that new capacity, when built, would most likely take the form of either expansions to existing large mills, or would be new large mills located where self-treatment would likely be the treatment mode. Therefore, we did not consider mills connected to municipal treatment plants as a part of the mill closing analysis.

Guidelines for commission finishers allow a greater variability of wastes, since commission finishers are expected to handle a wider variety of fibers, fabrics, and dyes than non-commission houses, and to operate on much shorter runs of a given production lot. The less stringent guidelines allowed to commission finishers will, however, have a negligible effect on treatment system costs as can be seen in Table 2-1. We calculated the BPT costs of Table 2-1 for both commission and non-commission finishers, but because of the small differences coupled with the added uncertainty of costs to comply with BAT, we did not calculate the BAT costs for commission finishers.

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*EPA Textile Industry Point Source Category Effluent Guidelines and Standards, Federal Register, Vol. 39, No. 130, Part II, July 5, 1974.

**EPA-440/1-74-022a, Development Document for Effluent Limitations Guidelines and New Source Performance Standards for the Textile Mills Point Source Category, June 1974.

New source standards have been established as being equivalent to BPT, except that suspended solids are restricted to 0.64 times that allowed BPT. This performance is expected to be achieved by the same technology as used for BPT, but with the addition of multi-media filtration. We have ignored the new source standards in this analysis on the basis of the following assumptions:

- In the foreseeable future, most added capacity in the textile industry will take the form of additions to existing mills, and so will not constitute "new sources";
- Those grass-roots mills that are constructed will probably be "large" mills because of the economics of size, and hence do not fall within the criteria established in this study as "mills subject to closure."

Best available technology (BAT) for the textile industry, as specified by the EPA, includes the preliminary screening, primary settling (wool scouring only), coagulation (carpet mills only), secondary biological treatment by extended aeration and stabilization ponds, listed under "best practicable technology." In addition, it includes lime treatment and multi-media filtration.

Textile chemists, waste treatment engineers, and technicians evaluated the suitability of lime treatment and multi-media filtration for the treatment of textile effluents. Color concentration is no longer a controlled characteristic of the effluent, so lime treatment, followed by multi-media filtration, is intended as a polishing step to remove residual BOD and COD to meet BAT guidelines. This treatment has not been demonstrated on an actual textile effluent and proven to be adequate (in particular for removing polyvinyl alcohol, certain disperse dye carriers and soluble dyes).

In some unusual cases a mill will be situated in a location which prohibits the use of secondary biological treatment and lagooning, and further is prevented from discharging to a municipal treatment plant either because the municipal treatment plant does not exist, or it is not large enough to handle the additional discharge of the textile mill, or refuses to accept the mill's industrial wastes. If such conditions were to exist, and this would be an unusual condition, the mill would have to decide whether to change its product mix, move its operation, or install a high-rate, activated sludge, two-stage treatment plant.

TABLE 2-1

INVESTMENTS AND OPERATING COSTS TO MEET BPT AND BAT GUIDELINES

Categories

	(1) Wool Scouring		(2) Wool Finishing			(4) Woven Finishing				(5) Knit Finishing				(7) Stock & Yarn Dyeing			
	S/M	L	S	M	L	S	M	L (A)*	L (B)*	S	M	L (A)*	L (B)*	S	M	L (A)*	L (B)*
Production (1000 lb/day)	22.5 †	52.8 †	9.5	33.5	55	9.0	72.5	100	150	15.0	40	80	120	11	24	40	60
Water Use (gal/lb)	3.0	3.0	13.8	13.8	13.8	18	18	18	18	20	20	20	20	22	22	22	22
Treatment Plant Size (mgd)	0.068	0.19	0.13	0.46	0.76	0.16	1.3	1.8	2.7	0.3	0.8	1.6	2.4	0.23	0.53	0.88	1.32
BOD Removed (lb/day)	2048	4804	876	3089	5071	236	1900	2620	3930	332	884	1768	2652	520	1040	1732	2598
BPT for mills required to meet normal guidelines																	
($'000)																	
Capital Investment	151	265	98	205	278	86	278	342	442	117	200	304	397	110	170	227	293
Annual Costs	41	71	30	59	79	27	79	96	123	35	57	86	111	33	49	65	83
BPT for mills qualifying as Commission Finishers																	
Commission Finishing																	
($1000)																	
Capital Investment	–	–	–	–	–	87.1	284.2	350.0	453.5	119.4	205.3	313.5	410.3	111.2	172.2	230.2	297.6
Annual Costs	–	–	–	–	–	27.05	79.3	96.5	123.7	35.2	57.3	86.5	111.8	33.05	49.1	65.2	83.3
BAT (incremental)																	
($1000)																	
Capital Investment	107	156	197	349	441	217	570	668	816	286	452	651	770	256	372	473	574
Annual Costs	28	43	49	89	114	54	152	181	228	72	118	174	213	64	95	124	153
BAT (including BPS)																	
($1000)																	
Capital Investment	258	421	295	554	719	303	848	1010	1258	403	652	955	1163	366	542	700	867
Annual Costs	68	114	79	148	193	81	231	277	351	107	175	260	324	97	144	189	236

*Two mills – (A) and (B) – were selected to provide a range of costs for large mills.

Large mill (A) was used to provide additional revenues to meet BAT guidelines.

†Based on clean (degreased) wool product weight.

We have not addressed this space-limited mill condition, since on investigation we feel that such situations do not really exist or, if they do, they are so few and have such special conditions that they warrant individual mill-by-mill treatment.

For each of the options discussed above, the mills would have to decide how to make the new investments in pretreatment or treatment equipment. In some cases, the mill might choose to fund the investment from its operations. The majority of the small- and medium-size mills would probably finance the investment in new treatment facilities. Conventional financing might be available through banks handling a company's general banking needs, but in other cases, probably the majority, the financing would be made available only with Federal or State guarantees. Another form of financing would be through industrial bonds issued by the local municipality. In each case, the mill would be able to continue operations and the problem would merely be one of how to finance or fund the new investments required.

Some industry sources believe that marginal operations exist and that these operations are so marginal that they cannot acquire any kind of financing. The contractor found one case in which the State limits the amount of corporate indebtedness of firms under its jurisdiction, which provides an artificial limit to financing pollution abatement. In the case of the marginal mill, it would be faced with either closure or discontinuance of the wet process operation, thus changing the product mix. Obviously, this latter option would not be available to those who are simply commission dye houses, except in that instance where a process change or product mix change might produce an effluent more readily treatable. If none of the above options is open to the mill, the mill would have to close.

e. Financial Profiles. We derived financial profiles for each category from field interviews, contractors' in-house knowledge, and other industry sources. The profiles represent commission houses, with the exception of the small raw wool scouring and wool dyeing and finishing. A summary of pertinent financial data drawn from each composite mill representation of its category and size classification is presented in Table 2-2 (1973 basis).

f. Estimated Impacts. We estimated the impact of the guidelines on prices, plant closings, unemployment, communities, international trade, and other areas for each of the five categories. A comprehensive summary of our findings is given below.*

(1) Prices. In general, industry sources state that any added costs cannot be readily passed on to the mills' customers since the mills affected are the smaller, independent companies which work in the aftermarket of small lots for fill-in needs of the customers. Their price structure is determined by the larger corporations which do the volume production. The smaller firms may charge a small premium of 5% or so on the going rate, but if much more than that is charged, the larger mills will undertake the work. The larger companies have already accomplished much of the expenditures necessary to meet the best

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*This summary includes cost and impact findings not included in Chapter 1.

TABLE 2-2

FINANCIAL PROFILE SUMMARY – TEXTILE INDUSTRY
(categories included in this study)

Category	1. Raw Wool Scouring		2. Wool Dyeing and Finishing		
Mill Size	Small	Large	Small	Medium	Large
Sales/Year	$1,200,000	$7,500,000	$1,075,000-$5,375,000	$5,375,000-$17,500,000	$190,000,000
Profit after Taxes	$0-$4,400	$113,000	$0-$174,000	$0-$554,000	$0-$600,000
Depreciation Expenses	Negligible	Negligible	$10,800-$54,000	$53,800-$175,300	$190,000
Principal Repayment	Not Known	Not Known	Not Known	Not Known	Not Known
Annual Cash Flow	$0-$4,400	$0-$65,000	$10,800-$223,000	$53,800-$729,300	$190,000-$790,000

	4. Broad Woven, Dyeing, and Finishing			5. Knit Fabric Dyeing and Finishing		
	Small	Medium	Large	Small	Medium	Large
Sales/Year	$1,060,000-$2,120,000	$8,480,000-$15,900,000	$16,700,000	$1,605,000-$3,210,000	$5,082,500-$8,560,000	$13,700,000
Profit after Taxes	$0-$72,600	$0-$502,600	$0-$530,000	$0-$90,000	$112,200-$540,600	$290,000-$865,000
Depreciation Expenses	$74,200-$148,400	$593,600-$1,113,000	$1,170,000	$160,500-$321,000	$508,250-$856,000	$1,300,000
Principal Repayment	Not Known	Not Known	Not Known	$64,200-$128,400	$203,300-$342,400	$550,000
Annual Cash Flow	$74,200-$221,000	$593,600-$1,615,600	$1,170,000-$1,700,000	$96,300-$282,600	$415,200-$1,054,200	$1,590,000-$2,165,000

	7. Stock and Yarn Dyeing Mill		
	Small	Medium	Large
Sales/Year	$916,400-$2,687,500	$2,687,500-$5,375,000	$6,700,000
Profit after Taxes	$0-$76,400	$62,400-$174,200	$147,000-$215,000
Depreciation Expenses	$64,000-$188,100	$188,100-$376,250	$470,000
Principal Repayment	Not Known	Not Known	Not Known
Annual Cash Flow	$64,000-$264,500	$250,500-$550,500	$167,000-$685,000

practicable treatment (BPT) guidelines and, presumably, their present prices reflect this and other factors such as overseas competitive effects. Specific category comments follow.

Wool scouring is a special case. The wool market has been depressed for some time and mills have been closing with fair regularity, resulting in a highly competitive situation that precludes higher pricing.

Large, broad woven and knit mills may be able to pass on a good share of the costs in the case of the best practicable treatment, since the market there is reasonably strong. Stock and yarn dyeing mills also share a reasonably strong market at present and may be able to pass on at least a portion of the treatment costs.

Table 2-3 provides a summary of the base price currently charged for processing, and the incremental price increase that would result for the various treatment costs, if these costs could be passed on, assuming no mark-up by the mill.

(2) Plant Closings and Unemployment. The major conclusions resulting from the analysis described in the preceding sections are:

- There will be no mill closings in Categories 4 and 5 due to compliance with BPT and BAT guidelines;
- Mill closures due to compliance with the BPT and BAT guidelines in Categories 1, 2, and 7 are listed below:

	Closures	
Category	BPT	BAT
1	2	0
2	2	4
7	0	1

Table 2-1 presents the investment and operating costs required for textile mills operating in five categories to meet BPT and BAT guidelines. The mills qualifying as commission finishers are covered by a separate set of guidelines which essentially doubles the standard BOD and COD discharge levels. The production levels listed in Table 2-1 are based upon the small- and medium-size representative mills presented in Section 1-g – Industry Profiles. We also selected the examples of larger mill sizes shown in Table 2-1 to use as a basis for calculating expected price increases for finished goods that the larger mills may pass on to help defray the costs of BAT.

Table 2-4 presents the summary of impact (Categories 1, 2, 4, 5, and 7), for mills which are subject to normal guidelines. The table includes the total number of mills in the category, the estimated employment, and the mills and employees potentially impacted. The BPT expected impact is based upon the "closing" model and employs the annual cash flows for 1977 and the estimated annual treatment costs for BPT.

TABLE 2-3

PRICE IMPACT SUMMARY
($)

	1. Wool Scouring*		2. Wool Dyeing and Finishing		
	Small/Medium	Large	Small	Medium	Large
Base Price ($/pound of product)	0.13	1.73	$1.43		
Incremental Price for:					
BPT, Self-Treatment	0.0036	0.0027	0.013	0.007	0.0057
BAT, Self-Treatment†	0.0061	0.0043	0.033	0.013	0.0140

	4. Woven Goods Dyeing and Finishing			5. Knit Goods Dyeing and Finishing		
	Small	Medium	Large	Small	Medium	Large
Base Price ($/pound of product)	0.37-0.70			0.53		
Incremental Price for:						
BPT, Self-Treatment	0.0120	0.0044	0.0038	0.0078	0.0048	0.0034
BAT, Self-Treatment	0.0360	0.0827	0.011	0.0233	0.0146	0.0102

	7. Stock and Yarn Dyeing		
	Small	Medium	Large
Base Price ($/pound of product)	0.54		
Incremental Price for:			
BPT, Self-Treatment	0.0120	0.0065	0.0052
BAT, Self-Treatment	0.0353	0.0192	0.0151

*Based on weight of grease wool, not finished product.

†Includes BPT costs.

TABLE 2-4

SUMMARY OF IMPACT FOR MILLS SUBJECT TO NORMAL GUIDELINES – CATEGORIES 1, 2, 4, 5, AND 7

		Category								
		(1) Wool Scouring	(2) Wool Dyeing & Finishing		(4) Broad Woven Dyeing & Finishing		(5) Knit Fabric Dyeing & Finishing		(7) Stock and Yarn Dyeing	
Total Mills in Category		5	76		208		455		128	
Total Employment in Category		557	9,400		27,700		30,500		8,300	
Mill Size		Small & Medium	Small	Medium	Small	Medium	Small	Medium	Small	Medium
Mills Potentially Impacted		0	20	12	9	5	3	1	22	4
Employees Potentially Impacted		0	1,800	3,600	675	2,250	120	100	500	240
BPT Expected Impact										
Annual Cash Flow			$10,800	$53,800	$74,200	$593,600	$96,300	$417,200	$64,000	$250,500
Circa 1977			$223,000	$729,300	$221,000	$1,615,600	$282,600	$1,054,200	$264,500	$550,500
Annual Treatment										
Cost for BPT			$30,000	$59,000	$27,000	$79,000	$35,000	$57,000	$33,000	49,000
Expected Mill										
Closings Caused										
By Implementation of BPT	Mills	0	2	0	0	0	0	0	0	0
	Employment	(0)	(180)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Percentage Impact	Mills	0	0	2.6%	0		0		0	
	Employees	0	0	1.9%	0		0		0	
	Production	0	0	1.9%	0		0		0	
BAT Expected Impact										
Cash Available in 1983 to Defray BAT Treatment			$17,000	$88,600	$84,100	$675,800	$120,000	$492,300	$83,300	$307,000
Costs* (Equals Annual Cash Flow Plus Incremental Revenues)			$257,800	$828,100	$240,700	$1,639,400	$330,100	$1,180,800	$321,000	$663,500
Annual Treatment Costs BAT (includes BPT)			$79,000	$148,000	$81,000	$231,000	$107,000	$175,000	$97,000	$144,000
Mill Closings (After Price Increase)										
Due to BAT										
	Mills	0	3	1	0	0	0	0	1	0
	Employment	(0)	(270)	(90)	(0)	(0)	(0)	(0)	(23)	(0)
Percentage Impact	Mills	0	5.3%		0		0		0.8%	
	Employ	0	3.8%		0		0		0.3%	
	Production	0	3.8%		0		0		0.3%	

*If competitive conditions prevailing in 1983 permit large mills to pass on the incremental cost of BAT as a price increase, then the impact on small and medium size mills may be reduced as they too pass on a proportion of these costs. The proportion that the small and medium mills may pass on is equal to the percentage price increase times their annual sales. The resulting increase in revenues may not cover all incremental BAT treatment costs and some mills may still be impacted.

Based upon this closing model and the associated cash flows and treatment costs, two mills in Category 2 – Wool Dyeing and Finishing – are expected to close. If this is in fact the case, then employment and production curtailment will be minimal (about 2%). Three additional Category 2 mills will be impacted in 1983 with an employment and production curtailment of 3%, and one mill in Category 7 – Yarn and Stock Dyeing and Finishing – will be impacted with an employment and production curtailment of less than 1%.

Table 2-5 presents the summary of impact for mills qualifying under the commission finisher exemption and thus subject to a separate set of guidelines. The impact was estimated in the same manner that it was for mills complying with normal guidelines. Two mills in Category 1 – Wool Scouring – are expected to close in 1977, and these closures may be attributed to effluent guidelines.

We believe that these two mills, both located in Massachusetts, may close in spite of the effluent guidelines, simply with the passage of time and the further diminished demand for scoured wool. If the wool market should reverse its trends, then these mills might be subject to impact because of the guidelines and/or they might be in a satisfactory financial condition perhaps to meet their operating costs from operating revenues. The latter occurrence is not anticipated, however.

In addition, compliance with BAT guidelines can be expected to cause closure of three additional small yarn and stock dyeing and finishing mills, again with an employment and production curtailment of less than 1%.

(3) Community Impacts. A large percentage of the small and medium sized independent mills are located in small communities where the mills hold a significant position. They often account for up to 5% of the town's direct employment, and sometimes as much as 30%. Hence, although the impact may be small in light of the total industry, local impacts will be significant.

(4) International Trade. In terms of international trade, the impact of the guidelines on the industry appears to be of little consequence. If, in fact, the guidelines produced a much greater effect than predicted in this study, imports would be further encouraged since the smaller, independent mills provide the fast turnaround on small lots that neither the large domestic mills nor the overseas mills can provide.

(5) Study Limitations. This study was undertaken to permit an estimate of the economic impact that the effluent guidelines may have upon certain subcategories of the textile industry, in terms of potential mill closings. The level of effort permitted resulted in an analysis that was more judgmental than analytical. The major economic impact that will occur within the textile industry will occur to companies which are generally small, privately held, and are very reticent and, in many cases, actually refused to reveal details of their financial profitability and expected impact of the effluent guidelines on their businesses. Responsible and knowledgeable people were contacted for discussion of the composite mill

TABLE 2-5

SUMMARY OF IMPACT FOR MILLS QUALIFYING UNDER COMMISSION FINISHER EXEMPTION

		(1) Wool Scouring	(2) Wool Dyeing & Finishing		(4) Broad Woven Dyeing & Finishing		(5) Knit Fabric Dyeing & Finishing		(7) Stock & Yarn Dyeing	
Commission Finishers Drawn from										
Category										
Total Commission Finishers Drawn										
from Each Category		7	3		131		76		64	
Estimated Employment		720	0		28,500		3,900		1,880	
Mill Size		Small & Medium	Small	Medium	Small	Medium	Small	Medium	Small	Medium
Mills Potentially Impacted		3	0	0	81	50	62	14	53	11
Employees Potentially Impacted		465	0	0	6,000	22,500	2,500	1,400	1,200	660
BPT Expected Impact										
Annual Cash Flow		$0-$65,000	$10,800	$53,800	$74,200	$593,600	$96,300	$417,200	$64,000	$250,500
Circa 1977			223,000	729,300	721,000	1,615,600	282,600	1,054,200	264,500	550,500
Annual Treatment										
Cost for BPT		$41,000	$30,000	$59,000	$27,000	$79,000	$35,000	$57,000	$33,000	$49,000
Expected Mill Closings Caused										
By Implementation										
Of BPT No. Mills		2	0	0	0	0	0	0	0	0
No. Employees		(165)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Percent Impact	Mills	29.0%	0		0		0		0	
	Employees	22.9%	0		0		0		0	
	Production	22.9%	0		0		0		0	
BAT Expected Impact										
Cash Available		$20,000-$106,000	$17,000	$88,600	$84,100	$675,800	$120,000-	$492,300	$83,300	$307,000
in 1983 to Defray			to	to	to	to	to	to	to	to
BAT Treatment			$257,800	$828,800	$240,700	$1,639,400	$330,100	$1,180,800	$321,000	$663,500
Costs (Equals Annual Cash Flow plus Incremental Revenues)										
Annual Treatment Costs		$69,000	$79,000	$148,000	$81,000	$231,000	$107,000	$175,000	$97,000	$144,000
Expected Mill										
Closings (After Price Increase) Due										
to BAT										
No. Mills		0	0	0	0	0	0	0	0	0
No. Employees		(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Percent Impact	Mills	0	0		0		0		0	
	Employees	0	0		0		0		0	
	Production	0	0		0		0		0	

for each sub-category and size classification and these persons believe that the composites are representative of their category and size classification. On that basis the study is presented as an initial view of the impact that the proposed effluent guidelines will have upon this industry.

Follow-on studies, should they be required, can build upon the methodology used in this study to improve the understanding of the impact that the guidelines will have upon this industry. For example, the number of interviews conducted could be increased to a point that forms a statistically valid sample of the industry in each category. We anticipate that the statistical sample will be developed on the basis of personal interviews and the balance of the industry could be conducted by means of mail questionnaires sent to companies listed in Davidson's Blue Book or similar directories.

g. Industry Profiles. This chapter presents a profile of the five sectors of the textile industry considered in this study. Based in part on the Annual Survey of Manufacturers, a Department of Commerce publication, each profile presents a table illustrating the size distribution of mills according to number of employees, as defined by the Annual Survey, followed by a figure showing the number of mills, size distributions, and mills on municipal water treatment systems. Raw wool scouring contains a more detailed description of its current status, since this industry segment appears to be in a particularly poor financial condition.

The discussion on size distribution is followed in each case by the types of plants considered, their geographic distribution, the type of product segments of the sector which will be affected by the requirements to meet the guidelines, and a brief financial profile.

(1) Category 1 – Raw Wool Scouring.

(a) Current Status

- **Outlook.** The consumption of clean wool in the United States declined drastically between 1960 and the present, dropping from 411.1 million pounds in 1960 to 219.2 million pounds in 1972.* Current annual U.S. production is estimated at 131 million pounds⁺ of clean wool, and there is about 50% excess production capacity now available (based on a 3-shift, 5-day week, 50-week year). This severe curtailment of wool production is resulting in an accelerated shutdown trend with at least one mill closing per year. The surviving mills and the individual status of each are shown in Table 2-6.

The sharp decrease in production has been attributed to a very poor wool market between 1968 and the present. Conditions were initially depressed because of the rise in popularity of synthetic fibers which had the double impact of cutting strongly into the wool

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*Source: Department of Agriculture Textile Organon

⁺ADL Survey, May 1974.

TABLE 2-6

PROFILE OF THE RAW WOOL SCOURING INDUSTRY

Company	Commission Scouring	Commission Top	Integrated with Weaving & Finishing	Production (millions of lbs/yr)	Number of Scouring Lines	Number of Employees	Shifts	Work Week Days per Week	Recover Grease Yes	Recover Grease No	Type of Waste Treatment
Bollman Industries San Marcos, Texas	X			7.0	3	45	1	5	X		Evaporation Lagoon plus Landfill
Hudson Combing Co. Inc. Hudson, Mass		X		8.0	1	43	2	2.5		X	Evaporation Lagoon plus Landfill
Roddie Wool Scouring Co. Inc., Brody, Texas	X			56.0	7	79	1	5		X	Evaporation Lagoon plus Landfill
San Angelo Wool Processing Co., San Angelo, Texas		X		2.0	1	13	1	5	X		Evaporation Lagoon plus Landfill
Santee River Wool Combing Co. Inc., Jamestown S.C.		X		20.0	3	300				X	Aerobic Lagoon
Gilet Wool Scouring Corp. N. Chelmsford, Mass	X			6.35	4	65	1	4 (10 hr days)	X (crude)		No Treatment Waiting on Town/State/Corps
Southwell Combing Co. N. Chelmsford, Mass		X		12.0	2	100[1]	1	4 (6-7 hours)	X (refined)		No Treatment, Waiting on Town/State/Corps
Hart Wool Combing Inc. Holyoke, Mass.		X		32.0	2	75	2	5	X		Municipal: Have Town Acceptance, Waiting for Town to Build
Caron International[2] Rochelle, Ill.			X	0	1	0	0	0		X	Municipal
Columbia Wool Scouring Mills Portland Oregon			X	16	1	32	2	5	X		Municipal: Just Installing an ABCOR Molecular Sieve to Pretreat
Burlington Industries, Inc. Clarksville, Va.			X	79.2	3	350	3	5.5	X		Combined Mill Wastes By Act. Sludge: Planning Pre-treatment Grease Removal
J.P. Stevens & Co., Inc. Allendale, S.C.			X	22.5	1	150	3	4.5	X (refined)		5-day Oxidation Ditch & Clarif.
Totals	3	5	4	261.05	29	1,252	–	–	8	4	

[1] Down from 850, 2 years ago.

[2] Scouring is inactive at present: may be resumed.

fiber market, followed by the need to "fill the pipeline" with the new synthetic fabrics. Knit synthetic fabrics were the dominant fabric type causing this impact. Subsequently, wool production was curtailed and foreign purchase of wool (mostly Japanese) combined to create a world wool shortage, which served to inflate the price of wool.

Many mills are now working a short week, that is, one shift per day. The Wool Combing Company, Barre, Mass., one of the larger scourers, which was operating at a rate of 32 million pounds of raw wool scoured per year, shut down in May 1974, while Amos Abbot of Dexter, Maine, a small scouring firm, which also weaved and finished woolen fabric, discontinued raw wool scouring earlier in 1974. As a mill closes, its business becomes divided among the survivors, permitting a sort of respite until the advent of the next crisis.

Because of underutilization of equipment, all of which is old and already fully amortized, the commission scouring mills appear to be at – or close to – zero profit and cash flow levels, waiting for a return of the wool market. As a matter of fact, wool has just about been priced out of the marketplace, and the future does not look bright for the scouring industry.

The firms involved in both commission scouring and top making are facing the same poor market conditions as those mills performing commission scouring alone. However, some top makers own the wool they process, and hence may be in a slightly better position to stay in business a little longer – anticipating better times.

The scouring mills that are part of an integrated operation, including weaving and finishing fabric, appear to be the only scouring mills that are operating close to capacity, and they will probably survive for the immediate future. In addition, the larger scouring mills in Texas may continue also, because of their proximity to the sheep slaughterhouses and the acceptance of their current waste treatment by lagooning, evaporation, and landfill. The future of the remaining mills remains in serious doubt.

The use of wool in carpets has declined even more drastically than in clothing. In fact, one carpet mill closed down its raw wool scouring operations only last year with the intent of purchasing scoured wool from abroad, but the market for woolen rugs has not warranted such purchases.

It would appear then that further attrition may be expected in this industry before wool demand possibly stabilizes and the surviving mills once more become profitable.

- Company Status. Each of the companies listed in Table 2-6 is discussed in this section.

Bollman Industries
San Marcos, Texas

Bollman, which has three scouring lines, is not operating to capacity, and performs commission work only. The firm employs 45 on two workshifts, 5 days a week, but not all its lines are operating. Bollman recovers grease and refines it for sale. Its wool yield, on the average, is 50%, but this figure varies greatly. The firm owns property in the country that contains an evaporation pond where its scouring wastes are treated. The residue from evaporation is land-filled. The State checks this operation quarterly.

* * * * * *

Roddie Wool Scouring Co., Inc.
Brady, Texas

Roddie has 7 lines and 79 employees performing commission scouring. The firm, which is the largest wool scourer, also is not running to full capacity. Roddie handles its wastes in the same manner as Bollman.

* * * * * *

San Angelo Wool Processing Co.
San Angelo, Texas

With one scouring line and 13 employees, San Angelo is operating at about 25% of full capacity. The firm, which normally has 50 employees working full time, performs commission scouring, carding, and combing, and also handles sheep skins as a separate part of its business. San Angelo recovers grease from sheep's wool, but not when processing mohair. Its waste waters pass through four settling/evaporation lagoons and a pit. The overflow is sent to the town sewer, while settled sludge is taken to a sanitary landfill.

* * * * * *

Hudson Combing Co., Inc.
Hudson, Mass.

With one scouring line and 43 employees, Hudson performs commission scouring, carding, and combing, but is running below capacity. The firm operates its scouring line for two shifts every other day. It does not recover grease. Hudson handles its waste waters in its own lagooning system and so does not discharge to streams.

* * * * * *

Santee River Wool Combing Co., Inc.
Jamestown, S.C.

Santee has two scouring lines, but one is not now in use; the second is being operated during three shifts, six days a week. Santee performs commission scouring, carding, and combing. The firm employs 300 and processes its waste water in an aerobic lagoon, but has to further treat it. Santee cannot depend on evaporation/landfill, as in the Texas mills, since rainfall exceeds the evaporation rate. Santee stated that an alliance of wool processors overseas is studying means of taking care of wool scouring wastes, but the results won't be available for a year. Meanwhile, the confusion over guidelines has left the firm in the position of not knowing what to do. No treatment approaches the firm knows to be in existence achieve close to the numbers it has seen being considered as effluent treatment goals.

* * * * * *

Gilet Wool Scouring Corp.
North Chelmsford, Mass.

Gilet is a commission scourer, employing 60-65, including supervisors. The firm has 4 scouring lines, works one 10-hour shift, 5 days a week for 50 weeks/year. Gilet has been recovering grease since 1964 and sells it as crude. The firm handles all kinds of domestic as well as imported wools, so shrinkage varies from 10 to 85% with an average of 35-40%. Its sales are based on current pricing of 7¼ to 7½ cents per pound of raw wool scoured, with a 20% surcharge added to partially cover sharply rising costs of handling.

The Town of North Chelmsford voted in funding for a treatment plant, but subsequently cancelled it. Gilet spent $85,000 on pretreatment facilities in its anticipation, so now the firm doesn't know what to do. Mr. Gilet made the point that if funds were to be made available to implement the 2-year-old Bill that Congress passed that provides 3%-30 year money for constructing treatment plants, Gilet could probably meet guidelines and stay in business.

* * * * * *

Southwell Combing Co.
North Chelmsford, Mass.

Southwell Combing is a scouring-top making operation, mostly commission. The firm, which employs 100 (down from 850 several years ago), has two scouring lines and works one shift (6-7 hours) 4 days a week. Southwell recovers grease and sells it as a neutral grease at 2% moisture. The firm also does a small amount of dry processing on synthetics and chlorine shrinking work. If the firm has to discontinue scouring, it would go out of business completely. Actually Southwell is in the same situation with respect to municipal treatment as Gilet – the Town having cancelled plans for a treatment plant.

* * * * * *

Hart Wool Company, Inc.
Holyoke, Mass.

With two scouring lines and an employment of 75, Hart works two shifts, five days a week. The firm recovers grease, and has had its waste waters accepted by the City of Holyoke which is proceeding with a municipal plant. Although Hart is a commission scourer, carder, and comber, it does much of its work for its own top company.

* * * * * *

Caron International
Rochelle, Ill.

Caron has one scouring line, but it is inactive. This is an integrated mill with spinning and weaving of fabric. With the current poor wool market, Caron is handling mostly synthetics. The firm may start up the wool scouring mill if the market turns up. Its wastes are accepted by the municipal plant. The firm does not recover grease.

* * * * * *

Columbia Wool Scouring Mills
Portland, Oregon.

Columbia is part of the Pendleton woolen mills, and all of its output goes to Pendleton. The firm recovers lanolin and is selling it at anywhere from $0.45 to $0.68 per pound (most lanolin goes for $0.25/lb). Columbia works two shifts a day all year-round and three shifts for about four months during Pendleton's peak season, and works a 5-day week. The firm employs 32 (counting supervisors and a secretary), and operates one four-tank scouring line. The firm is acquiring an ABCOR membrane (molecular sieve) to treat the grease recovery centrifuge effluent before discharging to the municipal sewers. This constitutes a pretreatment for municipal treatments. Presumably it will remove all greases and oils but will leave a BOD load due to the detergent. Columbia does not recycle its waste water; once through, it then dumps it.

* * * * * *

Burlington Industries, Inc.
Clarksville, Va.

Burlington Industries (BI) has closed down its raw wool scouring operations at Lees Carpet Division in Virginia permanently. At Clarksville, the firm does not do any commission scouring: all its output goes to the Clarksville finishing plant. BI employs about 350 in the scouring and top making area, and operates three scouring lines, five to six days per week, on three shifts. It recovers 30-40% of the wool grease by centrifuge. It was treating its scouring wastes, combined with the finishing mill wastes, but is about to obtain bids on systems to pretreat its scour waste before combining for an activated sludge treatment. BI is considering air flotation among other methods. The firm talked with ABCOR in November 1973, but at that time ABCOR's only experience was with whey, which it considers a very simple separation compared to scour wastes. BI made the point that current costs for concrete and iron pipe have skyrocketed since February of this year, putting under question any costs derived prior to that time.

* * * * * *

J. P. Stevens, Inc.
Allendale, S.C.

Stevens operates one scouring line on three shifts for 4-5 days per week. All its output is used by Stevens. Stevens has secondary treatment and has been reported upon in the guidelines studies. The firm is currently providing operating data to EPA.

(b) Process Description. Wool scouring is conveniently separated from other segments of the textile industry because of its uniqueness. Raw wool (grease wool) must be wet-cleaned (wet-processed) before the fiber can be dry-processed to produce top yarn, then fabric.

The grease wool contains 25 to 75% non-wool materials, consisting of wool grease (a recoverable material of some economic value) and other materials of animal origin such as urine, feces, sweat, and blood, as well as dirt consisting of both oil and vegetable matter. Additional materials that may be present include insecticides (sheep dip) and fugitive dyes used for identification. This variability in both yield and the composition of impurities and grease causes a correspondingly large variability in raw waste loads.

Scouring consists of sorting the fleece and feeding it to a hopper. The fleece is wet with fresh water in the first bowls. The wool is then carried through a series of scouring bowls where scour liquor flows countercurrent to it. Detergent is added in the third or fourth bowls to emulsify the greases and oils. The scoured wool is then dried. In mills where the cleaned wool is converted into top wool, the wool is combed and drawn – and sometimes air-washed – to remove the short fibers (used for wool yarn) from the long fibers (used for worsted yarn).

The wool grease constitutes a special problem in treatment since it does not appear to be readily biodegradable, unless it is well-emulsified so that bacteria can reach it. Therefore, the grease-recovery step is important to reduce pollution. The scour liquor from the separation tank is processed to break the emulsion and recover the wool grease. Two methods are commonly used in this procedure: centrifuging and acid-cracking.

In the centrifugal method, about 60 percent of the grease is recovered, and the remaining 40 percent is attached to the dirt and grit. Centrifuging recovers over 90 percent of the grease from the scour liquor. In the acid-cracking method, pilot plant performance indicates a 98 percent recovery of grease from the degritted liquor. No data are available to indicate the initial split of grease between the grit and the raw liquor from the grit settling tank. Grease yield, in total, is 8 to 15 percent by weight of the greasy wool, and this constitutes 50 to 65 percent of the wool grease initially present. Note that 1 to 3 percent of the wool grease present in the grease wool is allowed to remain on the wool as a conditioner. The market for recovered, unrefined wool grease is very unpredictable. The demand varies between zero and a level permitting a price of $0.25 per pound. When prices are depressed, the mill stores the grease for up to 6 months or more, making it an unattractive business for many operators.

Some "raw" wools, mostly the Australian and New Zealand wools, are prescoured at the source. However, this fact does not appear to affect this analysis of U.S. raw wool scouring mills significantly. Scoured wool is often converted into "tops" at the same mill. In this operation, the short fibers are separated mechanically from the long ones; the long fiber "tops" are used for worsted yarn and the short fibers are used to blend into woolen yarns. No added pollution occurs, but the water load is increased slightly by water washing of the air from an air washing step. The guidelines developed for Category 1 are based on the total product fiber and include both short fibers and tops.

Several small mills are connected to municipal treating systems. Most small mills are not treating their wastes at all. The larger mills are treating their own wastes, with the exception of Wellman in South Carolina which is connected to a municipal system. Two large Burlington mills treat wastes combined from carpet and woolen broad-woven fabric finishing plants, respectively. We are not considering as exposed those mills which are integrated into a large corporate organization. This criterion reduces the mills exposed from 16 to 12.

(c) Number of Establishments. The 1967 Census of Manufactures indicated 68 establishments engaged in wool scouring and/or worsted combing. A contractor survey taken in May 1974 found only 12 scouring mills remaining with one of these curently inactive. A listing of these mills and the status of each is given in Section g(1)a above.

This sharp decrease has been attributed to a very weak wool market over the 1968-1974 period. Conditions were initially depressed because of the rise in popularity of synthetics, and later by the shortage of wool and its rise in price to a level where it was close to being priced out of the market.

There are only three mills that may be potentially impacted. These are commission mills which are not connected to municipal treatment facilities, or are not treating their wastes by evaporative lagooning and landfill, as the mills in Texas are doing. In addition, all integrated mills already have their own treatment facilities, or are connected to municipal systems, and, because of their stronger financial posture, they are not considered to be subject to impact due to the implementation of the guidelines.

The distribution of mills is summarized in Figure 2-1.

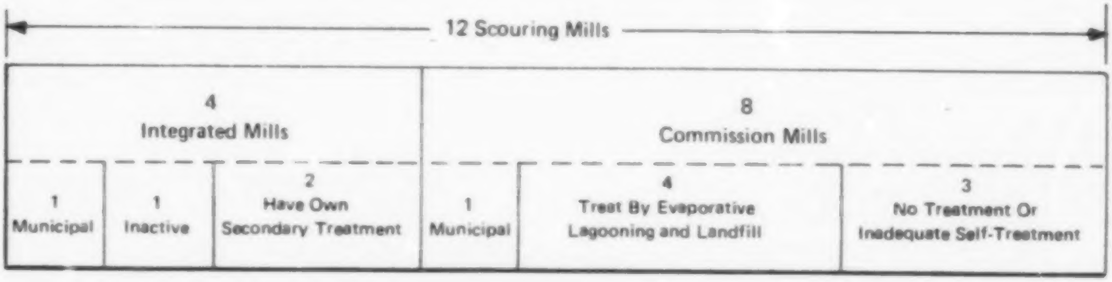
12 Scouring Mills
4
Integrated Mills
8
Commission Mills
1
Municipal
1
Inactive
2
Have Own
Secondary Treatment
1
Municipal
4
Treat By Evaporative
Lagooning and Landfill
3
No Treatment Or
Inadequate Self-Treatment

FIGURE 2-1 NUMBER OF MILLS IN CATEGORY 1: RAW WOOL SCOURING

(d) Size Distribution. The active mills vary in size as shown in Table 2-7.

TABLE 2-7

CATEGORY 1
SIZE OF RAW WOOL SCOURING MILLS

Number of Scouring Lines/Mill	Number of Mills in Operation	Total Scouring Lines	Total Number of Employees
1	4	4	238
2	2	4	175
3	3	9	695
4	1	4	65
7	1	7	79
	11	28	1,252

Production in the raw wool scouring mills ranges from 2 to 80 million pounds of grease wool processed per year. Actual production per mill is dependent on both the number of scouring lines and the number of shifts worked per week.

The number of employees involved with each operation runs roughly to 14 employees per scouring line per shift. When top making is included in the same mill with scouring, as many as 50 employees may support each scouring line.

(e) Number of Employees. The total direct labor employment in the raw wool scouring industry is currently 1,252.* The three mills which will potentially be impacted have a total current employment of 465.

(f) Composite Raw Wool Scouring Mill. The wool scouring mills assumed subject to impact are the commission scouring and top-making mills that are not connected to municipal treatment plants. The Texas mills will not be impacted since they are using evaporative lagoons and sanitary landfill. The representative mill uses a basis of raw wool processed and assumes that the mills represented are strictly commission houses that conform to the definition of a commission finisher.

We obtained limited financial data from spokesmen of these mills that indicated the following:

Scouring Mill:	Profit – negative Cash Flow – close to zero
Scouring and Top Mill:	Profit – zero Cash Flow – zero

In addition, we were told that the "before tax" profit for commission houses is no higher than 1½% on sales.

Present charges for commission work are approximately $0.10 per pound of grease wool scoured, and $0.30 per pound of grease wool scoured and processed into top. These figures include baling for shipment. Table 2-8 presents the financial status of a representative commission raw wool scouring mill.

(g) Cost of Treatment. The cost of waste treatment for raw wool scouring wastes is shown in Table 2-9 below. The guidelines may be met by discharging the mill effluent to a municipal treatment plant or by self-treatment. The wool scouring mill effluent has a special problem of high grease content that creates problems in both treatment and sludge disposal. As a result most municipal systems have refused to accept wool scour wastes, even after recovery of wool grease (which only removes about 60% of the grease and oils). Work is actively being performed by at least one wool scourer to make these wastes acceptable to the municipality. Further, we understand Caron International is on a municipal system. Also, mixed dye house and scouring wastes are being treated successfully in several private treatment plants. For purposes of this analysis, we will assume that this grease problem will be overcome without significant capital or operating costs involved; if it develops that such costs are significant, they will have to be considered in the impact analysis.

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*Contractor Survey, May 1974.

TABLE 2-8

REPRESENTATIVE COMMISSION RAW WOOL SCOURING MILLS

	Small	Large
Profit (before taxes)	0-1-1/2% $0-$20,000	0-1-1/2% $0-$112,500
Profit (after taxes)	0-1/2% $0-$4,000	0-3/4% $0-$65,000
Depreciation	Negligible	Negligible
Debt Repayment	Unknown	Unknown
Cash Flow	$0-$4,400	$0-$65,000
Salvage	Negligible	Negligible
Cost Structure		
Fixed	19% $228,000	19% $1,425,000
Variable	81% $972,000	81% $6,075,000
Production (grease wool basis)	12,000,000 lb/year 48,000 lb/day	25,000,000 lb/year 100,000 lb/day
Work Week	5 Day, 1 Shift	5 Day, 1 Shift
Water Use (grease wool basis)	18 MGY 0.07 MGD 1.5 gal/lb	30 MGY 0.12 MGD 1.5 gal/lb

(h) Potential Impact. Based on the mill closing criteria used in this report, of the three commission mills potentially impacted, compliance with BPT may cause two mills to close, but the additional revenue due to increased prices will result in no further closings when compliance with BAT guidelines is required in 1983.

The scouring mills that are integrated with weaving, dyeing, and finishing will still have to face additional expenditures for pretreating their scouring wastes for grease removal before blending with other wastes in their own treatment plants, or discharging into municipal systems, but they are in a more sound position financially than the commission mills.

The mills in Texas depend on lagooning the wastes and allowing evaporation (quite rapid in their region) to take place, followed by sanitary landfill of the resulting cake: biological digestion occurs that eventually renders the waste harmless. The result is a low-cost treatment. Hence, these mills will not be impacted if this treatment method is permitted to continue.

TABLE 2-9

COSTS AND INVESTMENTS TO MEET BPT & BAT GUIDELINES – WOOL SCOURING

	Small/Medium
Production (1000 lb/day)	45
Water Use (gal/lb)	115
Treatment Plant Size (mgd)	0.068
BOD removed (lb/day)	2048
BPT, for Mills Subject to Normal Guidelines ($1000)	
Capital Investment	151
Annual Costs	41
BPT for Mills Qualifying as Commission Finishers ($1000)	
Capital Investment	151
Annual Costs	41
BAT (incremental) ($1000)	
Capital Investment	107
Annual Costs	28
BAT (Total) ($1000)	
Capital Investment	258
Annual Costs	69

The large mill, used as a model for determining the potential price rise to cover BAT costs, was one with an annual production of 100 million pounds of grease wool, and the hypothetical mill would require a price rise of $0.00163/pound of grease wool. This allowable price rise would yield an increased revenue for the potentially impacted mills of from $20,000 to $40,750. Adding this sum to the existing cash flows shown in Table 2-9 yields funds available to offset BAT treatment costs of $20,000 to $105,750. A summary of these figures and their potential impact is shown in Table 2-10.

TABLE 2-10

REVENUES AND COSTS OF TREATMENT: CATEGORY 1 – RAW WOOL SCOURING

	Cost to Treat	Funds to Offset BAT Treatment Costs	Potential Impact
BPT	$41,000	$0 – 65,000	63%
BAT	$69,000	$20,000 – $105,750	57%

Tables 2-11 and 2-12 summarize, respectively, the impacts on mills subject to normal guidelines and on mills qualifying under the commission finisher exemption.

(i) Passed on Costs of BAT. Determination of the added revenue that the small/medium size raw wool scouring mill may expect to generate from increased prices to help defray BAT costs is shown in Table 2-13.

TABLE 2-13

ADDED REVENUE FOR BAT: CATEGORY 1 – RAW WOOL SCOURING

Assumed large mill production:	26.4 million pounds/year
Annual incidental operating cost for large mills:	$43,000/year
Incremental price increase/pound that the large mill would pass on:	$0.00162
Increased revenues small/medium mill	$20,000 – $106,000

(2) Category 2 – Wool Fabric Dyeing and Finishing

(a) U.S. Wool Industry – General

(1) U.S. Fiber Consumption. The consumption of wool declined drastically between 1960 and 1972. Table 2-14 illustrates a fiber consumption of 411 million pounds in 1960 declining to 219 million pounds in 1972.

(2) Looms in Place. To ascertain woolen and worsted productive capacity, we analyzed the number of looms producing fabric that were in place between 1965 and 1972. Table 2-15 illustrates that in 1[illegible]65 approximately 7000 looms were engaged in the manufacture of woolen and worsted fa[illegible] declining to an estimated 3000 looms in 1972.

(3) Index of Industrial Production. Table 2-16 illustrates the index of industrial production between 1960 and 1972, where total textile mill products rose from 100 in

TABLE 2-11

SUMMARY OF IMPACT OF CATEGORY 1 (WOOL SCOURING) MILLS SUBJECT TO NORMAL GUIDELINES

Category: (1) Wool Scouring	
Total Mills in Category	5
Total Employment in Category	557
Mill Size	small and medium
Mills Potentially Impacted	0
Employees Potentially Impacted	0
BPT Expected Impact	
Annual Cash Flow	–
Annual Treatment Cost of BPT	–
Expected Mill Closings Caused by Implementation of BPT	
Mills	0
(Employees)	(0)
Percent Impact	
Mills	0
Employees	0
Production	0
BAT Expected Impact	
Cash Available in 1983 to Defray BAT Treatment Costs* (Equals Annual Cash Flow Plus Incremental Revenu	–
Annual Treatment Costs BAT	–
Mill Closings (After Price Increase) Due to BAT	
Mills	0
(Employees)	(0)
Percent Impact	
Mills	0
Employees	0
Production	0

* If competitive conditions prevailing in 1983 permit large mills to pass on the incremental cost of BAT as a price increase, then the impact on small and medium sized mills may be reduced as they too pass on a portion of these costs. The proportion that the small and medium mills may pass on is equal to the percentage price increase times their annual sales. The resulting increase in revenues may not cover all incremental BAT treatment costs and some mills may still be impacted.

TABLE 2-12

SUMMARY OF IMPACT FOR MILLS QUALIFYING UNDER COMMISSION FINISHER EXEMPTION

Commission Finishers Drawn from Category	(1) Wool Scouring
Total Commission Finishers Drawn from Each Category	7
Estimated Employment	720
Mill Size	small and medium
Mills Potentially Impacted	3
Employees Potentially Impacted	465
BPT Expected Impact	
Annual Cash Flow Circa 1977	$0-$65,00
Annual Treatment Cost – BPT	$41,000
Expected Mill Closings Caused by Implementation of BPT	
Mills	2
(Employees)	(165)
Percent Impact	
Mills	29.0%
Employees	22.9%
Production	22.9%
BAT Expected Impact	
Cash Available in 1983 to Defray BAT Treatment Costs * (Equals Annual Cash Flow Plus Incremental Revenues)	$20,000-$106,000
Annual Treatment Costs	$69,000
Expected Mill Closings (After Price Increase) Due to BAT	
Mills	0
Employees	(0)
Percent Impact	
Mills	0
Employees	0
Production	0

* If competitive conditions prevailing in 1983 permit large mills to pass on the incremental cost of BAT as a price increase, then the impact on small and medium sized mills may be reduced as they too pass on a portion of these costs. The proportion that the small and medium mills may pass on is equal to the percentage price increase times their annual sales. The resulting increase in revenues may not cover all incremental BAT treatment costs and some mills may still be impacted.

1967 to 114 in 1972. Wool fabrics, on the other hand, declined from a total of 100 in 1967 to 44 in 1972.

TABLE 2-14

TOTAL FIBER CONSUMPTION
(millions of pounds)

Year	Cotton	Man-made Fiber	Wool
1960	4,191.0	1,874.7	411.1
1965	4,477.4	3,614.1	387.0
1970	3,815.6	5,501.3	240.3
1972	3,841.3	7,588.0	219.2

Source: Dept. of Agriculture Textile Organon

TABLE 2-15

WOOLEN AND WORSTED LOOMS IN PLACE

Year	No. of Looms
1965	6,967
1970	3,735
1972	2,881

Source: Dept. of Commerce, Bureau of the Census, 1967

TABLE 2-16

INDEX OF INDUSTRIAL PRODUCTION

		Annual Averages		
	1967	1970	1971	1972
Total index	100.0	106.6	106.8	114.4
All manufacturing	100.0	105.2	105.2	113.1
Textile mill products	100.0	106.3	108.6	114.5
Cotton fabrics	100.0	87.4	90.7	86.5
Man-made fabrics	100.0	125.6	118.9	133.4
Wool fabrics	100.0	72.5	47.5	44.3
Knit goods	100.0	130.5	134.3	147.7
Fabric finishing	100.0	90.1	89.1	92.1
Carpeting	100.0	129.3	148.0	164.1
Yarn & misc. textiles	100.0	96.6	103.3	107.3

Source: U.S. Federal Reserve System

(b) Scenario of Wool* Dyeing and Finishing

(1) General Description. The 1967 Census figures for SIC 2231, Wool manufacturing and Finishing, indicate 310 mills operating in this category. Of these, perhaps 160 are still in business, mostly being located in the northeast region. This figure of 160 mills reduces to a total of 76 that are potentially exposed to impact by the guidelines. We estimate that these 76 mills are composed of 23 very small, 33 small, and 20 medium sized mills.

Most small mills do commission dyeing, and even the larger mills that are part of the larger corporations commonly perform commission dyeing in addition to their own dyeing. Commission dyeing operations imply a wide range of fabrics and finishes as well as fiber types.

Probably not more than 5 or 10 mills still process more than 50% wool and wool blends; the rest process synthetic fabrics principally.

Wool finishing has been differentiated from other finishing categories because (1) the fiber is dirtier than other fibers, (2) different chemicals are used, and (3) it involves high water usage per pound of product. Most northern mills are discharging directly to streams, while a few discharge to municipal systems or to their own treatment plants.

Category 2 involves a high water usage rate caused by washing after the "fulling" operation (peculiar to wool systems), because the higher quality fabric produced necessitates more washing and, finally many of the mills in this category are old mills with inefficient equipment and piping layouts.

Variations occur in processing, similar to other finishing categories, in that some fabrics are woven or knit from yarns that are already dyed, either in the fiber or yarn form. A given mill may dye and finish part of its production while only finishing the remainder. This variation is unpredictable and causes a spread in data on pollution generation.

(2) Process Description. There are three distinct finishing processes: stock, yarn, and fabric finishing. The pollution generated by the fabric finishing operation is similar to that generated by the other two, and thus it is included in this category. If the greige goods are 100 percent wool, they are first cleaned of vegetable matter (and cotton fibers) by carbonizing (soaking in strong sulfuric acid, dried, and crushed with the char separated from the cloth). The fabric is then cleaned of spinning oils and any weaving sizes by a light scour (detergent wash). The 100 percent woolens, with the exception of worsteds, are then dimensionally stabilized in the presence of detergents to produce a controlled shrinkage or "felting." Worsteds are hard, tightly-woven and dimensionally stable as received at the finishing plant; woolens are loosely-woven, soft and often are firmed up by fulling.

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*Wool includes not only that from sheep, but also that from other animals, such as alpaca, vicuna, and the Kashmir goat. Subsequent discussion here will address sheep's wool only: processing the other wool involves somewhat special finishing techniques.

The fabric is then batch-dyed in vessels called becks, washed in the same vessels, and taken to dry finishing operations. The only dry finishing operation of concern to water pollution is mothproofing.

(c) Number of Establishments. According to the 1967 Census of Manufactures, 310 mills were engaged in the manufacture of woolen and worsted woven fabrics, including dyeing and finishing. The Census breakdown by size is given in Table 2-17, and Figure 2-2 shows the number of mills potentially impacted and their size distribution.

TABLE 2-17

WEAVING AND FINISHING WOOL FABRICS – SIZE DISTRIBUTION

	No. of Establishments	No. of Employees (000's)
Total establishments	310	41.8
Establishments with an average of:		
1 to 4 employees	54	0.1
5 to 9 employees	17	0.1
10 to 19 employees	22	0.3
20 to 49 employees	64	2.0
50 to 99 employees	41	2.9
100 to 249 employees	60	10.3
250 to 499 employees	35	12.2
500 to 999 employees	14	13.9
1,000 to 2,499 employees	3	–

Source: 1967 Census of Manufactures

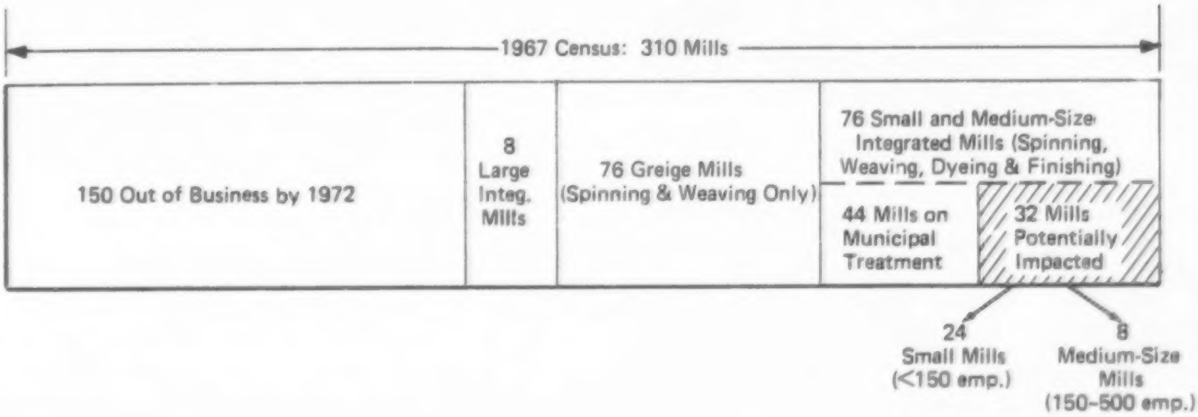
1967 Census: 310 Mills
150 Out of Business by 1972
8 Large Integ. Mills
76 Greige Mills (Spinning & Weaving Only)
76 Small and Medium-Size Integrated Mills (Spinning, Weaving, Dyeing & Finishing)
44 Mills on Municipal Treatment
32 Mills Potentially Impacted
24 Small Mills (<150 emp.)
8 Medium-Size Mills (150-500 emp.)

FIGURE 2-2 NUMBER OF MILLS IN CATEGORY 2 – WOOL FABRIC DYEING AND FINISHING

We estimate that of these mills have gone out of business since the 1967 Census.*

We estimate that there are eight large, integrated mills performing spinning, weaving, dyeing and finishing that are assumed capable of complying with both BPT and BAT guidelines.

Of the remaining 152 mills, we estimate that 50% (76 mills) have dyeing and finishing facilities.

Of these 76 small- and medium-size mills with dyeing and finishing facilities, we estimate that 44** are discharging to municipal treatment plants, and 32 have their own treatment plants, or are discharging without treatment, and hence will be potentially impacted only by required compliance with the guidelines. None of these latter mills appears to be a commission house by the definition of commission house used in this report. Integrated mills, however, occasionally perform some commission finishing in addition to their own work.

(d) Size Distribution and Employment. Of the 32 potentially impacted non-commission mills, 20 are small-size mills, while 12 are medium-size mills, assuming the same ratio as found in the 1967 Census for small mills employing less than 150 and medium-size mills employing more than 150.

The number of employees potentially impacted is shown in Table 2-18, for small-size mills employing less than 150 and for medium-size mills employing between 150 and 500, based on the employment shown in the representative mills.

TABLE 2-18

NUMBER OF EMPLOYEES POTENTIALLY IMPACTED IN CATEGORY 2 – WOOL FABRIC DYEING AND FINISHING

		No. of Employees
Non-commission mills (32) potentially impacted:		5,400
Composed of 20 small mills:	1,800	
and 12 medium mills:	3,600	
Non-commission mills (44) connected to municipal treatment		4,000
Total		9,400

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* Based on a review of Davison's Textile Directory, Sixty-Second Annual Edition, 1973 Davison Publishing Co., and ADL non-proprietary information.

** The number of small- and medium-sized mills on municipal systems is based on a June 6, 1972, Northern Textile Association survey of woolen mills in New England and Pennsylvania, in which 21 mills out of 29 reporting were on municipal systems. Of the remaining 47 mills, we assumed 50% to be on municipal systems. In addition, most wool mills are handling some synthetics as well as wool, since the poor wool market conditions occurred.

(e) Types of Plants. With the exception of four to six of the largest manufacturers, equipment for both weaving and finishing proved to be outmoded, and the level of technology was below average compared to competing European and Japanese mills.

(f) Geographic Distribution. Table 2-19 gives the geographic distribution of wool weaving and finishing mills in 1967 and shows that, of the total 310 mills, the northeast region accounted for two-thirds of the industry. In the north central region there were 22 establishments, 52 in the southern region, and 20 in the western region.

(g) Types of Products. The wool fabric industry basically produces two types of products:

(1) Worsted fabrics, the raw material of which is wool top. This is woven into medium- and light-weight fabrics, and is mostly used in men's tailored clothing, including slacks. Fabrics are 100% wool or of a blend of wool and polyester.

(2) Woolen-type fabrics that are composed of medium-weight and heavy fabrics and are utilized in both men's and women's sportswear. These fabrics are made of 100% wool or blends of various fibers with wool.

Because the raw materials of wool have doubled in price and the supply has been curtailed over the past 18 months, very few mills in the United States classified under this segment are engaged in the manufacture of 100% wool content fabric. In most cases, both in worsted- and woolen-type fabrics, blends of wool with other fibers are being manufactured.

(h) Segments to be Affected. Of the 310 establishments accounted for in the 1967 Census of Manufactures, we estimate about 150 of these went out of business between 1967 and 1972. Of the remaining mills, eight of the largest establishments have integrated weaving, dyeing, and finishing facilities, and account for 70% of the total fabric output. Of the remaining 152 mills, we estimate that 50%, or 76 of the mills, have their own dyeing and finishing facilities, and hence will be exposed to impact by the guidelines.

(i) Financial Profile. No pertinent information is available on mills exclusively engaged in woolen weaving, dyeing, and finishing, since the major factors in this business are divisions of large diversified textile companies, where the wool portion is only a small percentage of the total volume.

(j) Composite Wool Dyeing and Finishing Mills. The financial data of composite wool fabric finishing mills are presented in Table 2-20.

The composite mills are integrated mills performing spinning, weaving, dyeing, and finishing. The dry operations, such as spinning and weaving, are more profitable than dyeing and finishing, and help to carry the latter operations. Mill owners prefer to carry wet

TABLE 2-19

WOOL WEAVING AND FINISHING MILLS – GEOGRAPHIC DISTRIBUTION*

	No. of Establishments	No. of Employees (000's)
United States	310	41.8
Northeastern Region	216	22.2
New England Division	127	16.3
Maine	18	4.0
New Hampshire	16	3.6
Vermont	7	.4
Massachusetts	41	4.8
Rhode Island	36	2.2
Connecticut	9	1.1
Middle Atlantic Division	89	5.9
New York	39	3.2
New Jersey	10	.6
Pennsylvania	40	2.1
North Central Region	22	1.3
East North Central Division	12	.9
Ohio	5	2.5-5.0
Illinois	3	–
Wisconsin	2	–
West North Central Division	10	.5
Minnesota	6	–
Missouri	3	.2
South Region	52	17.2
South Atlantic Division	43	15.0
Maryland	3	1.0
Virginia	10	2.5
West Virginia	1	.5
North Carolina	6	4.0
South Carolina	11	2.5
Georgia	11	2.5
East South Central Division	7	1.0–2.5
Tennessee	2	1.0
Alabama	2	1.0
West South Central Division	2	–
Texas	2	–
West Region	20	1.1
Pacific Division	18	1.0–2.5
Washington	1	.5
Oregon	8	.5
California	9	.2

Source: Census of Manufactures, 1967

*The subtotals do not add up to totals, in all cases, since all geographic areas are not necessarily included.

operations in spite of their poor financial performance, since they provide the ability of fast response to an after-market when cutters need small lots of the more popular styles and shades, which the larger corporations find difficult to handle economically.

TABLE 2-20

REPRESENTATIVE WOOL DYEING AND FINISHING MILLS

	Small	Medium	Large
Sales	$1,075,000 – 5,375,000	$5,375,000 – $17,500,000	$19,000,000
Profit (before taxes)	0 – 6%	0 – 6%	0-6%
	$0 – $322,500	$0 – 1,653,000	$0-$1,140,000
Profit (after taxes)	0 – 3¼%	0 – 3.2%	0.3.2%
	0 – $174,000	0 – $554,000	$0-$600,000
Depreciation	$10,800 – $54,000	$53,800 – $175,300	$190,000
Debt	Not Known	Not Known	Not Known
Cash Flow	$10,800 – $223,000	$53,800 – $729,300	$190,000-$790,000
Salvage	$270,000	$877,000	$950,000
Cost Structure			
Sales exp.	10%	10%	10%
Fixed	$212,000 – $1,060,000	$1,058,000 – $3,525,000	$3,750,000-$4,000,000
	21%	21%	21%
Variable	$700,000 – $3,500,000	$3,490,000 – $11,600,000	$12,300,000-$13,000,000
	69%	69%	69%
Production	750,000 – 4,200,000 lb/yr	4,200,000 – 12,000,000 lb/year	13,750,000 lb/year
	3,000 – 16,000 lb/day	17,000 – 50,000 lb/day	55,000 lb/year
Employment	30 – 150	150 – 450	500
Work Week	5 day/wk, 1 shift	5 day/wk, 1 shift	5 Day/Week 1 Shift
Water Use	14.5 – 77.3 MGPY	82 – 242 MGPY	190 MGPY
	0.04 – 0.22 MGPD	0.23 – 0.69 MGPD	0.76 MGPD
	13.8 gal/lb	13.8 gal/lb	13.8 gal/lb

The price for finished wool fabric would be approximately $3.50 to $4.00 per pound for a large mill that owns its own wool and handles only wool. However, we have observed that wool fabric mills are performing some commission work and are also processing synthetic fibers as well as wool; these factors reduce the sales value per pound of product to a level ranging $1.28 to $1.46 per pound. These figures were used in this analysis.

The same remarks about the wool market made in Section g(1)b above, Raw Wool Scouring, apply to the wool fabric dyeing and finishing segment of the textile industry: the market is depressed, which is the reason for the price modifications given above.

(k) Cost of Treatment. The costs of treatment for the wastes from wool fabric dyeing and finishing are given in Table 2-21.

TABLE 2-21

COSTS FOR BPT AND BAT GUIDELINES – WOOL FINISHING

	Small	Medium
Production (1000 lb/day)	9.5	33.5
Water Use (gal/lb)	13.8	13.8
Treatment Plant Size (mgd.)	0.13	0.46
BOD removed (lb/day)	876	3089
BPT for Mills Subject to Normal Guidelines ($1000)		
Capital Investment	98	205
Annual Costs	30	59
BAT for Mill Qualifying as Commission Finishers ($1000)		
Capital Investment	98	205
Annual Costs	30	59
BAT (Incremental) ($1000)		
Capital Investment	197	349
Annual Costs	49	89
BAT (Total) ($1000)		
Capital Investment	295	554
Annual Costs	79	148

(l) Potential Impact. The potential impact on the wool fabric dyeing and finishing industry is shown in Tables 2-22 and 2-23. The former is for mills subject to normal guidelines; the latter for mills qualifying under commission finisher exemption.

(m) Passed-on Costs of BAT. Determination of the added revenues that the small- and medium-size wool fabric dyeing and finishing mills may expect to generate from increased prices to help defray BAT costs are shown in Table 2-24.

TABLE 2-22

SUMMARY OF IMPACT ON CATEGORY 2 WOOL DYEING AND FINISHING MILLS SUBJECT TO NORMAL GUIDELINES

Category		(2) Wool Dyeing and Finishing	
Total Mills in Subcategory		76	
Total Employment in Category		9,400	
Mill Size	small		medium
Mills Potentially Impacted	20		12
Employees Potentially Impacted	1,800		3,600
BPT Expected Impact			
Annual Cash Flow Circa 1977	$10,800- $223,000		$53,800- $729,300
Annual Treatment Cost – BPT	$30,000		$59,000
Expected Mill Closings Caused by Implementation of – BPT			
Mills	2		0
(Employees)	180		(0)
Percent Impact			
Mills 2.6%		0	
(Employees) 1.9%		0	
Production 1.9%		0	
BAT Expected Impact			
Cash Available in 1983 to Defray BAT Treatment Costs* (Equals Annual Cash Flow Plus Incremental Revenues)	$17,000- $257,800		$88,600- $828,800
Annual Treatment Costs – BAT	$79,000		$148,000
Mill Closings (After Price Increase) Due to BAT			
Mills	3		1
(Employees)	(270)		(90)
Percentage Impact – BAT			
Mills		5.3%	
Employees		3.8%	
Production		3.8%	

* If competitive conditions prevailing in 1983 permit large mills to pass on the incremental cost of BAT as a price increase, then the impact on small and medium sized mills may be reduced as they too pass on a portion of these costs. The proportion that the small and medium mills may pass on is equal to the percentage price increase times their annual sales. The resulting increase in revenues may not cover all incremental BAT treatment costs and some mills may still be impacted.

TABLE 2-23

SUMMARY OF IMPACT FOR MILLS QUALIFYING UNDER COMMISSION FINISHER EXEMPTION

Commission Finishers Drawn from Category		(2)	
Total Commission Finishers Drawn from Each Category		0	
Estimated Employment		0	
Mill Size	small		medium
Mills Potentially Impacted	0		0
Employees Potentially Impacted	0		0
BPT Expected Impact			
Annual Cash Flow Circa 1977	$10,800- $223,000		$53,800- $729,300
Annual Treatment Cost – BPT	$30,000		$59,000
Expected Mill Closings Caused by Implementation of BPT			
Mills	0		0
(Employees)	(0)		(0)
Percent Impact			
Mills		0	
Employees		0	
Production		0	
BAT Expected Impact			
Cash Available in 1983 to Defray BAT Treatment Costs* (Equals Annual Cash Flow Plus Incremental Revenues)	$17,000- $257,800		$88,600- $828,800
Annual Treatment Costs	$79,000		$148,000
Expected Mill Closings (After Price Increase) Due to BAT			
Mills	0		0
(Employees)	(0)		(0)
Percent Impact			
Mills		0	
Employees		0	
Production		0	

* If competitive conditions prevailing in 1983 permit large mills to pass on the incremental cost of BAT as a price increase, then the impact on small and medium sized mills may be reduced as they too pass on a portion of these costs. The proportion that the small and medium mills may pass on is equal to the percentage price increase times their annual sales. The resulting increase in revenues may not cover all incremental BAT treatment costs and some mills may still be impacted.

TABLE 2-24

ADDED REVENUE FOR BAT: CATEGORY 2 – WOOL FABRIC DYEING AND FINISHING

Assumed Large Mill Production:	13.7 million pounds/year
Annual Incremental Operating Costs for Large Mills:	$114,000/year
Incremental Price Increase/Pound that the Large Mill Would Pass On:	$0.00832
Increased Revenues:	
Small Mill	$6, 700 – $34,800
Medium Mill	$34,800 – $99,500

(3) Category 4 – Broad Woven Fabrics – Dyeing and Finishing (Cotton and Synthetics).

(a) General Description. According to the Census of Manufactures, during 1967 a total of 449 establishments were engaged in the dyeing and finishing of synthetic and cotton woven goods. Table 2-25 illustrates the relative position of cotton finishing plants and synthetic finishing plants between 1958 and 1970. During that period there was a drastic reduction of employment. In cotton finishing plants, an employment level of 49,000 in 1958 declined to 29,000 in 1970. Employment in synthetic finishing plants rose from 16,000 in 1958 to 34,000 in 1970. This trend directly reflects a shift in U.S. mill fiber consumption between 1958 and 1970. Other indicators, such as value added and value of shipments, also reflect this trend. Of the 449 establishments (in 1967) engaged in dyeing and finishing synthetic and cotton woven goods, about 146 are very small mills employing less than 20 people, while 167 are small mills, employing between 20 and 99, and 102 are medium size mills employing between 100 and 500 workers.

TABLE 2-25

BROAD WOVEN FABRICS – DYEING AND FINISHING

	No. Employees (000's)	Payroll ($MM)	Value Added ($MM)	Cost of Materials ($MM)	Value of Shipments ($MM)	Capital Expenditures ($MM)	Total Plants
Cotton finishing plants: ratio of concentration, 1967: 4 large, 42%; 8 large, 59%							
1958	49.2	189.9	289.1	399.1	686.2	15.7	
1970	28.9	180.1	252.7	304.2	603.0	22.9	216
Synthetics finishing plants: ratio of concentration, 1967: 4 large, 37%; 8 large, 49%							
1958	16.2	74.3	114.8	95.3	210.7	3.6	
1970	33.8	220.4	429.0	608.9	1,011.6	29.3	233

Source: Annual Survey of Manufacturers, 1970

The types of plants vary greatly, depending on the size and the type of products they process, since the industry is engaged in bleaching, printing, dyeing, and finishing. The smaller plants, with 19 employees or less, in most cases have old equipment that has not been modernized due to lack of capital resources. The larger plants, both independent and those that are part of weaving complexes, are modern and efficient.

(b) Process Description. This category is one of the most important, because such plants are responsible for much of the waste water effluent load of the textile industry. Integrated woven fabric finishing mills are also included in this category rather than in category 3 because the greige goods section of these mills contributes only a small amount to the overall effluent load.

When starch sizing is used in preparing woven fabrics, it becomes the major contributor to the BOD load of the plant. Another commonly employed sizing is polyvinyl alcohol (PVA), which tends to be less biodegradable than starch and therefore presents a lower BOD level, while contributing significantly to the COD load.

Mill wastes generally have a high total of dissolved solids and color (dyestuffs), and contain a variety of dye-dispersing agents. The use of caustic soda to mercerize cottons produces an effluent of high pH dyes, and their associated additives represent the most complicated treatment problem, since the BOD and COD load, as well as color, can vary considerably with the type of dyed fabric being processed and the color effects to be achieved.

Wet process steps include greige goods scouring, bleaching, mercerizing (cotton), dyeing, washing, and rinsing, followed by application of finishes such as soil repellants, antistatics, and the like.

(c) Number of Establishments and Size Distribution. According to the 1967 Census of Manufactures, 449 establishments were engaged in the dyeing and finishing of synthetic and cotton woven goods. The Census breakdown by size is given in Table 2-26 and illustrates the following:

> Cotton Finishing: Cotton finishing is a highly fragmented industry where small plants (50 employees and under) accounted for more than half the establishments, or 122.
>
> Synthetic Finishing: In synthetic finishing, there is a similar pattern, where plants with up to 50 employees accounted for 50% of all establishments, or 115.

We estimate that 110 mills have gone out of business since the 1967 Census. Of the remainder, 34 large integrated mills with more than 500 employees, according to the contractor's criteria, will not be impacted.

TABLE 2-26

WOVEN FABRICS

(Dyeing and Finishing Establishments)
1967

	Number of Establishments	Number of Employees (000's)
Finishing plants – cotton:		
Total establishments	216	35.7
Establishments with an average of employees:		
1 to 4	42	0.1
5 to 9	13	0.1
10 to 19	25	0.4
20 to 49	42	1.4
50 to 99	29	2.0
100 to 249	26	4.6
250 to 499	15	5.6
500 to 999	21	21.6
1,000 to 2,499	1	–
2,500 or more	2	–
Finishing plants – synthetics:		
Total establishments	233	25.7
Establishments with an average of employees:		
1 to 4	21	–
5 to 9	14	0.1
10 to 19	31	0.5
20 to 49	49	1.7
50 to 99	47	3.5
100 to 249	44	7.1
250 to 499	17	5.8
500 to 999	9	7.0
1,000 to 2,499	1	–
2,500 or more	–	–

Source: Census of Manufactures, 1967

In addition, we estimate that 80 mills are integrated and will not be impacted.

Of the remaining 225 mills, we estimate that 80 are small mills that discharge to municipal treatment plants; 90% of the remainder, or 131, are commission finishers, and 10%, or 14, are mills that do not qualify under the definition of commission finishers.

Using the same ratio of mill sizes as given in the 1967 Census, we note that 131 commission mills are divided into 81 small mills with less than 250 employees, and 50 medium-size mills with from 250 to 500 employees. This categorization is depicted in Figure 2-3.

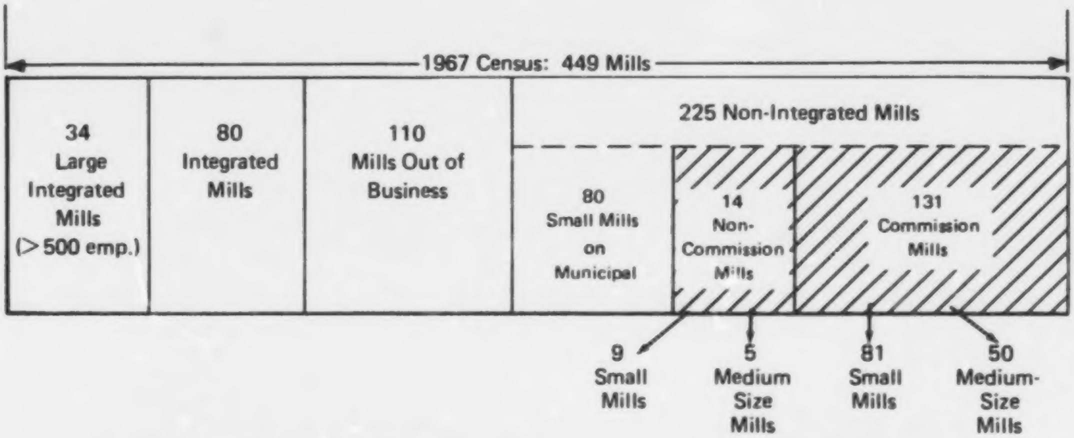
1967 Census: 449 Mills
34 Large Integrated Mills (> 500 emp.)
80 Integrated Mills
110 Mills Out of Business
225 Non-Integrated Mills
80 Small Mills on Municipal
14 Non-Commission Mills
131 Commission Mills
9 Small Mills
5 Medium Size Mills
81 Small Mills
50 Medium-Size Mills

FIGURE 2-3 NUMBER OF ESTABLISHMENTS: CATEGORY 4 – BROAD WOVEN FABRICS – DYEING AND FINISHING

(d) Number of Employees. We estimate the number of employees in this category to be 56,200. Those employees potentially impacted, based on the average employment in the representative mills, are listed in Table 2-27.

TABLE 2-27

NUMBER OF EMPLOYEES: CATEGORY 4 – BROAD WOVEN FABRIC DYEING AND FINISHING

		No. of Employees
131 Commission Mills		28,500
Composed of 81 small mills:	6,000	
50 medium mills:	22,500	
208 Non-Commission Mills		27,700
Composed of 9 small mills:	675	
5 medium mills:	2,250	
194 other mills not exposed:	24,775	

(e) Type of Plants. Types of plants vary greatly, depending on the size, and the types of products they process, since the industry is engaged in bleaching, printing, dyeing, and finishing. The smaller plants with no more than 50 employees, in most cases, have old equipment that has not been modernized due to lack of capital resources. The larger plants, both independent and those that are part of weaving complexes, are modern and efficient.

Most of the equipment found in woven goods finishing mills is old, much of it having been written off already. It will not be quite as old as that found in woolen finishing plants, however. The more progressive woven goods finishing mills will have had a small capital improvement program that may have resulted in at least a few jet becks as well as pressure becks and perhaps, in the larger mills, a continuous washer. The low profit levels, however, cause this depreciation expense to represent a significant part of the cash flow.

(f) Geographic Distribution. Tables 2-28 and 2-29 illustrate the geographic distribution of the industry. In cotton finishing plants the northeastern region accounted for the majority of establishments, mostly composed of the 125 out of 216 establishments. In the southern region, where most of the large integrated establishments are located, there are 67 establishments. The synthetic finishing plants show a similar pattern, where the northeastern region represents over 50%, or 177 plants, and the southern region 46 plants of a total 233.

(g) Level of Integration. There are basically two types of establishments:

(1) Those owned by large weaving mills: These are separate dyeing and finishing companies owned by large textile corporations, such as Burlington, Stevens, and Deering Milliken, which might within a single corporate complex own up to four finishing plants. We estimate that out of a total of 450 establishments 114 are integrated. However, value of shipments of these establishments accounted for an estimated 50 to 60% of the total dyeing and finishing industry.

(2) Commission dyers and finishers: We estimate that 211 of a total of 449 are independent commission dyers and finishers without corporate relationship to weaving mills. Their sole function is to commission-finish woven goods, supplying such services as bleaching, dyeing, printing, and finishing.

(h) Types of Products. Both the synthetic and cotton fabric finishing industries are engaged in processing the following products:

- Bleaching operation – the major volume is household domestics, including sheets and pillowcases;
- Dyeing, plain colors – a conversion of greige woven goods into dyed fabric for both apparel and household products;

- Printing – a conversion of woven greige goods into printed fabrics; and

- Special finishing – includes all processes after dyeing to impart special effects to fabrics, such as heat setting, water repellency, or other finishes.

TABLE 2-28

WOVEN FABRICS – COTTON DYEING AND FINISHING
(Geographic Distribution)

	No. of Establishments	With 20 or More Employees
Finishing Plants – Cotton:		
United States	216	136
Northeastern Regin	125	70
New England Division	37	27
New Hampshire	2	2
Massachusetts	15	11
Rhode Island	15	9
Connecticut	5	5
Middle Atlantic Division	88	43
New York	44	19
New Jersey	25	16
Pennsylvania	19	8
North Central Region	18	6
East North Central Division	14	4
Illinois	9	3
Southern Region	67	59
South Atlantic Division	54	49
Delaware	1	1
Maryland	3	3
Virginia	2	2
North Carolina	18	18
South Carolina	17	17
Georgia	10	6
East South Central Division	8	7
Tennessee	3	2
Alabama	3	3
West South Central Division	5	3
Arkansas	1	1
Oklahoma	1	1

Sources: Census of Manufactures, 1967, ADL estimates and industry listings.

TABLE 2-29

WOVEN FABRICS – SYNTHETIC DYEING AND FINISHING*

(Geographic Distribution)

	No. of Establishments	With 20 or More Employees
Finishing Plants – Synthetics:		
United States	233	167
Northeastern Region	177	124
New England Division	43	35
New Hampshire	1	1
Massachusetts	20	16
Rhode Island	9	8
Connecticut	13	10
Middle Atlantic Division	134	89
New York	58	28
New Jersey	67	54
Pennsylvania	9	7
Southern Region	46	39
South Atlantic Division	45	38
Virginia	5	5
North Carolina	24	21
South Carolina	10	9
Georgia	2	1
East South Central Division	1	1
Tennessee	1	1
West Region	6	2
Pacific Division	5	2
California	5	2

Sources: Census of Manufactures, 1967, ADL estimates and industry listings.

*The subtotals do not add up to totals, in all cases, since all geographical areas are not necessarily included.

(i) Financial Structure. Commission dye houses charge about $0.37 per pound for dyeing and finishing broadwoven fabrics, and $0.70 per pound for printing and other specialties. No published financial structure for independent dyeing and finishing establishments is available. We have therefore included financial data relating to large textile companies which own facilities for dyeing and finishing their own fabrics, or provide commission dyeing and finishing services (Table 2-30).

(j) Composite Mill. The following examples are for mills that do commission dyeing and finishing only. Those that do spinning and weaving as well will show a higher profit from the contribution of the dry processing, and the sales volume per pound of goods produced will increase by a factor of about 3.5. Therefore, they will be in better shape to

TABLE 2-30

FINANCIAL PROFILE

(Integrated Textile Mills with Dyeing and Finishing Facilities)

	Burlington Industries	J.P. Stevens	Merchants	Lowenstein	West Point Pepperell	Springs	Cannon Mills	Cone	Dan River	Fieldcrest
Net Sales ($MM)										
1970	1,822	893	708	387	374	308	306	298	293	212
1971	1,727	861	738	444	355	326	323	319	312	227
Net Profit ($MM)										
1970	71.4	6.3	17.4	8.3	8.7	6.2	15.6	4.8	(1.0)	7.8
1971	40.1	(0.6)	16.4	8.9	6.2	8.4	16.8	7.0	(2.6)	7.9
Profit Margin										
1970	3.9%	0.7%	2.5%	2.1%	2.3%	2.0%	5.1%	1.6%	–%	3.7%
1971	2.3%	–%	2.2%	2.0%	1.8%	2.6%	5.2%	2.2%	–%	3.5%
Return on Equity										
1970	10%	2%	7%	6%	5%	3%	7%	4%	–	10%
1971	5%	–%	6%	6%	3%	3%	7%	5%	–	10%
Return on Investment										
1970	6%	1%	4%	5%	5%	2%	7%	3%	–	6%
1971	4%	–%	4%	4%	3%	3%	7%	4%	–	6%
Capital Expenditures ($MM)										
1970	123	28	22	19	12	15	15	11	8	7
1971	104	30	16	25	10	17	12	12	10	7

Source: Based on Annual Reports

handle waste treatment costs. Table 2-31 presents typical ranges of the various business facets of representative mills involved in Category 4 operations.

TABLE 2-31

REPRESENTATIVE BROAD WOVEN DYEING AND FINISHING MILLS – CATEGORY 4

	Small	Medium	Large
Sales	$1,060,000-$2,120,000	$8,480,000-$15,900,000	$16,700,000
Profit (before taxes)	$0-$127,200	$0-$954,000	$0-$1,000,000
	0-6%	0-6%	0-6%
Profit (after taxes)	$0-72,600	$0-$502,600	$0-$530,000
	0-3.4%	0-3.2%	0-3.2%
Depreciation	$74,200-$148,400	$593,600-$1,113,000	$1,170,000
Debt Repayment	Not Known	Not Known	Not Known
Cash Flow	$74,200-$221,000	$593,600-$1,615,600	$1,170,000-$1,700,000
Salvage Value	$265,000-$530,000	$2,120,000-$3,975,000	$4,175,000
Cost Structure			
Fixed	$400,000-$752,000	$3,222,000-$5,640,000	$6,300,000-$6,000,000
	38%	38%	38%
Variable	$660,000-$1,240,800	$5,258,000-$9,306,000	$10,400,000-$9,700,000
	62%	62%	62%
Production	1,500,000-3,000,000 lb/yr	12,500,000-23,800,000 lb/yr	25,000,000 lb/yr
	6,000-12,000 lb/day	50,000-95,000 lb/day	100,000 lb/day
Employment	50-100	300-600	625
Work Week	5-6 days, 2-3 Shifts	5-6 days, 2-3 shifts	5-6 days, 2-3 shifts
Water Use	37.8-75.6 MGY	315 MGY	450 MGY
	6.1-6.2 MGD	0.9-1.71 MGD	1.8 MGD
	18.0 gal/lb	18.0 gal/lb	18.0 gal/lb

Commission dye houses will be more severely impacted than the integrated mills, since the latter are able to carry low-profit dye house performance by offsetting it with more profitable spinning and weaving operations. They prefer to do so (carry the wet operations) in spite of their poor performance, however, because the reason they exist is most often their ability to provide fast response to the aftermarket when cutters need small lots of the more popular styles and shades, and the larger corporations are not set up to handle these small lots economically.

(k) Cost of Treatment. The cost of treatment in the woven finishing work is presented in Table 2-32. The water use for the mills interviewed during this study was found to be about twice that proposed in the effluent guidelines. The water use for the example composite mill was reduced to the levels proposed in the guidelines. Therefore, we assumed that these mills could accomplish such a reduction in the use of water primarily by better operating practice (in process changes) rather than by any significant capital expenditures. If such investments or operating costs associated with the reduced water usage are necessary and significant, then such costs must be included in calculating the impact of the guidelines on the mill. As with other facets of the impact, this must be considered on a mill-to-mill basis and cannot be generalized upon. The raw waste loads of the mills interviewed were found to be similar to those described in the guidelines, and the composite mill is assumed to conform.

TABLE 2-32

BPT AND BAT GUIDELINES – WOVEN FINISHING

	Small	Medium	Large (A)	Large (B)
Production (1000 lb/day)	9.0	72.5	100	150
Water Use (gal/lb)	18	18.	18	18
Treatment Plant Size (mgd.)	0.16	1.3	1.8	2.7
BOD removed (lb/day)	236	1900	2620	3930
BPT for Mills Subject to Normal Guidelines ($1000)				
Capital Investment	86	278	342	442
Annual Costs	27	79	96	123
BPT for Mills Qualifying as Commission Finishers ($1000)				
Capital Investment	87.1	284.2	350.0	453.5
Annual Costs	27.05	79.3	96.5	123.7
BAT (incremental) ($1000)				
Capital Investment	217	570	668	816
Annual Costs	54	152	181	228
BAT (Total) ($1000)				
Capital Investment	303	848	1010	1258
Annual Costs	81	231	277	351

(l) Potential Impact. Summary of the impact on Category 4 – Woven Fabrics Dyeing and Finishing – mills subject to normal guidelines is presented in Table 2-33 and a summary of impact on Category 4 mills qualifying under commission finisher exemption is presented in Table 2-34.

TABLE 2-33

SUMMARY OF IMPACT ON CATEGORY 4 – BROAD WOVEN FABRIC DYEING AND FINISHING – MILLS SUBJECT TO NORMAL GUIDELINES

Category	(4) Broad Woven Dyeing and Finishing	
Total Mills in Category	208	
Total Employment in Category	27,700	
Mill Size	small	medium
Mills Potentially Impacted	9	5
Employees Potentially Impacted	675	2250
BPT Expected Impact		
Annual Cash Flow Circa 1977	$74,200- $221,000	$593,600- $1,615,600
Annual Treatment Cost – BPT	$27,000	$79,000
Expected Mill Closings Caused by Implementation of – BPT		
Mills	0	0
(Employees)	(0)	(0)
Percent Impact		
Mills	0	
Employees	0	
Production	0	
BAT Expected Impact		
Cash Available in 1983 to Defray BAT Treatment Costs* (Equals Annual Cash Flow Plus Incremental Revenues)	$84,100- $240,700	$675,800- $1,639,400
Annual Treatment Costs – BAT	$81,000	$231,000
Mill Closings (After Price Increase) Due to BAT		
Mills	0	0
(Employees)	(0)	(0)
Percentage Impact – BAT		
Mills	0	
Employees	0	
Production	0	

---

* If competitive conditions prevailing in 1983 permit large mills to pass on the incremental cost of BAT as a price increase, then the impact on small and medium sized mills may be reduced as they too pass on a portion of these costs. The proportion that the small and medium mills may pass on is equal to the percentage price increase times their annual sales. The resulting increase in revenues may not cover all incremental BAT treatment costs and some mills may still be impacted.

TABLE 2-34

SUMMARY OF IMPACT FOR CATEGORY 4
MILLS QUALIFYING UNDER COMMISSION FINISHER EXEMPTION

Commission finishers drawn from category			(4)	
Total commission finishers drawn from each category			131	
Estimated employment			28,500	
Mill size		small		medium
Mills potentially impacted		81		50
Employees potentially impacted		6000		22,500
BPT EXPECTED IMPACT				
Annual cash flow Circa 1977		$74,200- 221,000		$593,600- 1,615,600
Annual treatment cost — BPT		$27,000		$79,000
Expected mill closings caused by implementation of BPT				
# Mills		0		0
(# Employ)		(0)		(0)
Percent impact				
Mills	29.0%		0	
Employ	22.9%		0	
Production	22.9%		0	
BAT EXPECTED IMPACT				
Cash available in 1983 to defray BAT treatment		$84,100- $240,700		$675,800- $1,639,400
Costs (Equals annual cash flow plus incremental revenues)				
Annual treatment costs		$81,000		$231,000
Expected mill closings (after price increase) due to BAT				
# Mills		0		0
(# Employ)		(0)		(0)
Percent impact				
Mills			0	
Employ			0	
Production			0	

(m) Passed-on Cost of BAT. Added revenues that the small- and medium-size broad woven fabric dyeing and finishing mills may expect to generate from increased prices to help defray BAT costs are shown in Table 2-35.

TABLE 2-35

ADDED REVENUE FOR BAT: CATEGORY 4 – BROAD WOVEN FABRIC DYEING AND FINISHING

Assumed large mill production:	27.5 million pounds/year
Annual incremental operating costs for large mills:	$181,000/year
Incremental price increase/pound that large mills would pass on:	$0.00658
Increased revenues	
Small mill:	$9,900 – $19,700
Medium mill:	$82,200 – $156,600

(4) Category 5 – Knitted Fabric – Dyeing and Finishing (Cotton and Synthetics)

(a) General Description. The knitting industry is characterized by a large number of plants and a structure organized along specialized product segments. The major segments are knit-fabric piece goods, hosiery, outerwear, and underwear. The geographical distribution of knit mills (SIC Code 225), according to 1967 Census data, is as follows:

	No. Plants
Northeastern Region	1616
North Central Region	76
South Region	910
West Region	96
Total	2698

Census figures are available for mills that perform dyeing and finishing only (commission dyers) and for total knit mills which include both "knitting only," as well as commission finishers, and integrated establishments that have both knitting and dyeing and finishing. We have therefore estimated the breakdown between integrated finishing mills and those mills that do knitting only.

According to the Census of Manufacturers 1967, some 541 mills were engaged in the manufacture of knitted fabrics, including dyeing and finishing.

Table 2-36 illustrates the relative position of the industry between 1958 and 1970. Employment rose sharply from 18,000 in 1958 to 48,000 in 1970. A similar relationship is reflected in the value of shipments and capital expenditures. This relates directly to the fact that knitted fabrics have been the fastest growing segment of the textile industry in the United States between 1958 and 1970.

TABLE 2-36

DYEING AND FINISHING – KNITTED FABRICS
INDUSTRY GROWTH 1958-1970

	No. Employees		Value	Cost of	Value of	Capital
	No. (000)	Payroll ($MM)	Added ($MM)	Materials ($MM)	Shipments ($MM)	Expenditures ($MM)
1970	48.2	296.2	648.5	1,235.9	1,881.8	85.3
1958	18.4	73.9	147.4	336.1	487.2	7.1

Source: Annual Survey of Manufacturers, Dept. of Commerce

While the industry has shown substantial growth in value of shipments, we estimate that – through consolidation and other factors – the current number of plants in this industry is about 2,500. Of this number, we estimate that 1,100 plants have only dry operations. These are plants, such as sweater mills in the outerwear segment, which knit goods from purchased or commission dyed yarns, or mills which have finished goods dyed on a commission basis and therefore have no process water requirements. Most of these mills are located in the Northeast.

Of the 1,400 plants estimated to have wet process operations, we estimate that 85 percent discharge to municipal treatment systems. The great bulk of these are hosiery plants (700-800) located primarily in North Carolina, Tennessee, and Pennsylvania. Census data (1968) on process water use and discharge indicates that virtually all (more than 90%) of the hosiery plants discharge to municipal systems.

The knit fabric mills within this segment amount to about 541 mills. Of these, the commission finishers, about 90 mills, will be those most likely impacted. These plants are the source of finished knit piece or yard goods for the apparel, industrial, and household goods trades, and also supply fabric to underwear and outerwear manufacturers. The large knit fabric plants are located mainly in North and South Carolina and Georgia, but substantial numbers are also located in New York and Pennsylvania.

The production of knit fabrics for women's and men's wear has been the fastest growing sector of the textile industry over the past decade. Synthetic fibers are the predominant types used in knit goods, except for cotton goods produced for apparel, underwear, and sleepwear. In the latter case, however, polyester has been replacing increasing proportions of cotton fiber. Plants which previously processed only cotton are using greater amounts of polyester, and the trend is expected to continue.

(b) Process Description. The wet processing operations performed in knit fabric dyeing and finishing are described below, with specific operations employed varying from plant to plant.

Yarns are purchased in the undyed state, with a knitted oil finish to provide lubrication for the knitting operation. The amount of finish on the yarn ranges from 5-15 percent, depending on the type of yarn and fiber. There is a significant difference between knitting and weaving yarns, since the latter are sized with starch or other polymeric materials to add strength during the weaving operation.

After the yarn has been knit into fabric, the fabric may be processed by one or more alternative routes. Typically, it is processed in piece goods form. The fabric is washed in continuous countercurrent washers (warm water and detergent) prior to being loaded in dye machines. This washing step removes knitting oils and other contaminants. In some processes, washing is the first step in the dye machine cycle. The types of dyeing equipment used include: pressure becks, pressure jet becks, and sometimes atmospheric becks. The types of dyestuffs, auxiliaries, and conditions employed for dyeing knit goods are essentially the same as for woven goods of comparable fiber composition.

Most knit fabrics are treated with softeners, antistats, and resin finishes, and, in some cases, water and oil repellents. These finishes are applied from a pad bath just prior to the final drying and dry finishing operations. These baths are discharged periodically, as required, for fabric lot or formulation changes, but the total daily volume of discharge is very small.

(c) Size Distribution. Table 2-37 illustrates the size distribution of knit fabric mills and also illustrates the nature of the industry, which is highly fragmented with small plants being the dominant factor. Plants with under 50 employees per establishment accounted for a total of 371 establishments out of 541.

TABLE 2-37

KNITTED FABRICS MANUFACTURERS – DYEING AND FINISHING
(Size Distribution)

	No. of Establishments	No. of Employees (000's)
Total establishments	541	36.3
Establishments with an average of		
1 to 4 employees	95	.2
5 to 9 employees	59	.4
10 to 19 employees	93	1.3
20 to 49 employees	124	4.0
50 to 99 employees	63	4.6
100 to 249 employees	75	11.7
250 to 499 employees	23	7.7
500 to 999 employees	8	6.4
1,000 to 2,499 employees	1	–

Source: 1967 Census of Manufactures

Some 331 of these mills knit and dry-finish the fabric without dyeing and finishing and are classified as greige goods mills.

One-hundred and twenty of the remaining mills in this category are integrated mills that knit, dye, and finish fabric, and they are considered not to be significantly impacted by implementation of the guidelines. Of the remainder, we estimate that 10 mills have gone out of business since the 1967 Census.

Of the 80 non-integrated mills left, we estimate that 4 are non-commission mills (by the definition of commission mills used in this study) and 76 are commission mills.

Of the four non-commission mills, we estimate that three are small mills and one is medium-sized. Of the 76 commission mills, we estimate that 62 are small and 14 medium size. These categorizations are shown in Figure 2-4.

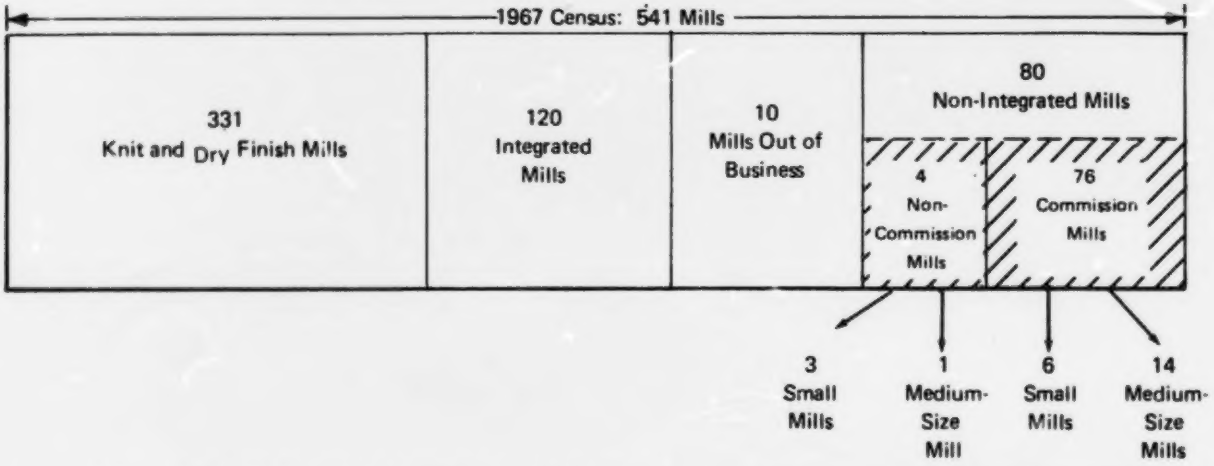
1967 Census: 541 Mills
331
Knit and Dry Finish Mills
120
Integrated Mills
10
Mills Out of Business
80
Non-Integrated Mills
4
Non-Commission Mills
76
Commission Mills
3
Small Mills
1
Medium-Size Mill
6
Small Mills
14
Medium-Size Mills

FIGURE 2-4 NUMBER OF ESTABLISHMENTS: CATEGORY 5 – KNIT FABRIC – DYEING AND FINISHING

(d) Number of Employees. The number of employees in this category and those potentially impacted, based on the average employment in the representative mills, are shown in Table 2-38.

(e) Types of Plants. The knitted fabric industry emerged in the United States in 1960. Therefore, most equipment on hand is relatively new. The age of plants in most cases varies from 15 to 5 years.

The level of technology is good and efficiency is excellent in the larger mills, and below average in the small and fragmented ones.

TABLE 2-38

NUMBER OF EMPLOYEES: CATEGORY 5
KNITTED FABRICS – DYEING AND FINISHING

		No. of Employees
76 Commission mills –		3,900
Composed of 62 small mills:	2,500	
and 14 medium mills:	1,400	
4 Non-commission, non-integrated mills –		320
Composed of 3 small mills:	220	
and 1 medium mill:	100	
451 other mills in this category:		30,180
Total		34,400

(f) Geographic Distribution. Table 2-39 shows the geographic distribution of the knitting industry with the northeastern region accounting for 398, or 74% of the mills, mostly in the Middle Atlantic section, with employment of 21,000. In the South there are 124 plants, mostly the large integrated mills, employing 14,000.

Table 2-40 gives the geographic distribution of mills engaged in dyeing and finishing in 1967. Of the total there were only 80 establishments, 63% of which were located in the Northeast, mostly the Middle Atlantic section, where there were 44 plants. The southern region accounts for 22 establishments, or 28% of the total. The current estimate of the number of mills is 90, and the geographic distribution has not changed significantly.

(g) Level of Integration. The level of integration in the knitted fabric industry can be divided into the following segments:

(1) Knitting mills engaged primarily in knitting and dry finishing (331 establishments). They purchase dyed yarn from outside sources and it is knitted on premises and dry-finished, or they purchase greige yarn that they knit on their own premises and have it commission dyed and finished by outside sources.

(2) Integrated knitting mills (120 establishments). These are the large knitwear producers of both warp and circular knit fabrics which, in addition to knitting, have yarn-dyeing facilities and piece-dyeing facilities. In most cases these mills dye and finish their total fabric requirements. In some cases, they also act as commission dyers and finishers for other parties.

(3) Knit goods fabric commission dyers and finishers (80 establishments). These are firms which predominantly work on a commission basis, performing a

service for knitting mills that do not have their own dyeing and finishing facilities.

TABLE 2-39

GEOGRAPHIC DISTRIBUTION OF KNITTED FABRIC MANUFACTURERS INCLUDING DYEING AND FINISHING*

	No. of Establishments	No. of Employees (000's)
United States	541	36.3
Northeastern Region	398	21.2
New England Division	43	6.0
Massachusetts	17	3.7
Rhode Island	12	1.0–2.5 est.
Connecticut	11	.4
Middle Atlantic Division	355	15.1
New York	233	6.8
New Jersey	60	2.8
Pennsylvania	72	5.6
North Central Region	12	.6
East North Central Division	7	.5–1.0 est.
Wisconsin	7	.5–1.0 est.
Southern Region	124	14.3
South Atlantic Division	113	12.3
Virginia	6	1.0
North Carolina	86	9.0
South Carolina	14	1.7
Georgia	5	.5–1.0 est.
East South Central Division	11	2.0
Tennessee	5	1.0–2.5 est.
Alabama	4	.4
Western Region	7	.2
Pacific Division	7	.2
California	7	.2

Sources: 1967 Census of Manufactures, ADL estimates and industry listings.

*The subtotals do not add up to totals, in all cases, since all geographic areas are not necessarily included.

TABLE 2-40

GEOGRAPHIC DISTRIBUTION OF KNITTED FABRIC DYERS AND FINISHERS ONLY*

	No. of Establishments
United States	80
Northeastern Region	50
New England Division	6
Massachusetts	3
Rhode Island	1
Connecticut	1
Vermont	1
Middle Atlantic Division	44
New York	24
New Jersey	12
Pennsylvania	8
Southern Region	22
South Atlantic Division	14
Virginia	2
North Carolina	10
South Carolina	2
East South Central Division	2
Tennessee	1
Florida	1
Unaccounted for	8

Sources: Census of Manufactures 1967, ADL estimates and industry listings.

*The subtotals do not add up to totals, in all cases, since all geographic areas are not necessarily included.

(h) Type of Products. The knitted fabric industry basically produces three types of products:

(1) Warp knit fabrics, both yarn and piece-dyed, composed of tricot and raschel types that predominantly utilize two raw materials – filament acetate, and filament polyester. Sixteen of the largest mills accounted for 60% of the total productive capacity.

(2) Double-knit fabrics, both yarn and piece dyed, which utilize predominantly polyester filament yarns and, to a lesser degree, nylon, acrylics, and cotton, and predominantly produce fabrics for the apparel trade. Twenty-eight of the largest mills accounted for 50% of total productive capacity.

(3) Single-knit fabrics, utilizing cotton, acrylics, polyester filament yarn and piece dyed, for the apparel trades. Thirteen of the largest mills accounted for 40% of total productive capacity.

(i) Financial Profile. Table 2-41 represents the financial structure of the largest integrated knitting mills having their own dyeing and finishing facilities. Table 2-42 represents financial profiles of the largest independent commission finishers for knitted fabrics.

(j) Composite Mill. The composite small and medium mills are commission dyers and finishers. Because the average age of the equipment is much lower than in the other finishing categories, knit finishing operations have higher salvage and depreciation levels.

An increasing number of knit finishers are involved in knitting, along with dyeing and finishing. Their sales dollar per pound of product will be about twice as high as that of commission dyers. The profit for the dry operations is 1 or 2% (after taxes) higher than for dyeing and finishing.

Some mills in this category buy their own yarn, knit it, and then dye and finish the knitted fabric. In these mills, the sales dollar per pound of product will be about five times what the commission dyers charge. As in the case of the knitter/finisher described above, the profit level will be higher since the dry operations are more profitable than dyeing and finishing.

Note that employees are hourly employees and salvage value is for equipment only.

Table 2-43 presents typical ranges of the various business facets of representative mills involved in Category 5 operations.

A large percentage of the equipment found in knitting and knit finishing mills is relatively new. The higher temperatures needed for dyeing polyester with disperse dyes and the need to handle knits much more gently than woven piece goods have required new equipment designs: principally, the pressure jet beck. As a result, combined with the low profit level, depreciation is a major contributor to cash flow.

The composite mill is presented as a commission dye house, which should be more severely impacted than an integrated mill, since it cannot carry dye house losses or overhead by the more profitable dry operations.

Table 2-44 illustrates the relative position of the industry between 1958 and 1970. Employment rose sharply from 18,000 in 1958 to 48,000 in 1970. A similar relationship is reflected in the value of shipments and capital expenditures. This relates directly to the fact that knitted fabrics have been the fastest growing segment of the textile industry in the United States between 1958 and 1970.

TABLE 2-41

FINANCIAL PROFILE – PROFIT MARGIN OF INTEGRATED KNITTING MILLS

1970-1971

	Texfi Industries	Guilford Mills, Inc.	Stevecoknit	Edmos Corp	Scottex Corp
Net Sales ($MM)					
1970	97	43	27	25	15
1971	164	53	33	32	24
Net Profit ($MM)					
1970	5.3	0.7	1.6	1.8	0.8
1971	11.3	2.7	2.4	2.5	1.1
Profit Margin					
1970	5.5%	1.6%	5.9%	7.2%	5.3%
1971	6.9%	5.1%	7.3%	7.8%	4.6%
Return on Equity-Return on Investment					
1970	18% 12%	10% 6%	44% 25%	22% 17%	29% 13%
1971	25% 16%	37% 25%	27% 21%	14% 12%	11% 7%

Source: Based on Company Annual Reports

TABLE 2-42

FINANCIAL PROFILE – PROFIT MARGIN OF THE LARGEST COMMISSION DYERS OF KNITTED FABRIC (1969-1971)

	1969	1970	1971
United Piece Dye Works, Inc.:			
Net Sales ($MM)	28	28	30
Net Profit ($MM)	2.1	2.6	3.9
Profit Margin	7.5%	9.1%	13.2%
Return on Equity-Return on Investment	21% 15%	21% 17%	26% 23%
Capital Expenditures ($MM)	2	2	2

Source: Based on Company Annual Reports.

TABLE 2-43

REPRESENTATIVE KNIT FABRIC DYEING AND FINISHING MILLS – CATEGORY 5

	Small	Medium	Large
Sales	1,605,000 – $3,210,000	$5,082,500 – $8,560,000	$13,700,000
Profit (before taxes)	$0 – $160,500	$203,300 – $1,027,200	$548,000-$1,640,000
	0 – 5%	0 – 12%	4-12%
Profit (after taxes)	$0 – $90,000	$112,200 – $540,600	$290,000-$865,000
	0 – 2.8%	2.2 – 6.3%	2.1%-6.3%
Depreciation	$160,500 – $321,000	$508,250 – $856,000	$1,300,000
Debt Repayment	$64,200 – $128,400	$203,300 – $342,400	$550,000
Cash Flow	$96,300 – 282,600	$417,200 – $1,054,200	$1,590,000-$2,165,000
Salvage Value	$529,650 – $1,059,300	$1,677,200 – $2,824,800	$4,570,00
Cost Structure			
Fixed	$450,000 – $855,000	$1,368,000 – $2,112,000	$3,550,000-$3,700,000
	28%	27 – 28%	27-28%
Variable	$1,155,000 – $2,194,500	$3,511,200 – $5,420,800	$9,600,000-$9,500,000
	72%	73 – 72%	73-72%
Production	3,000,000 – 6,000,000 lb/yr	9,500,000 – 16,000,000 lb/yr	25,600,000 lb/yr
	10,000 – 20,000 lb/day	30,000 – 50,000 lb/day	80,000 lb/day
Employees	25 – 50	75 – 125	200
Work Week	5-6 day, 3 shifts	5-6 day, 3 shifts	5-6 days, 3 shifts
Water Use	70 – 140 MGY	210 – 350 MGY	512 MGY
	0.2 – 0.4 MGD	0.6 – 1.0 MGD	1.6 MGD
	20 gal./lb	20 gal./lb	20 gal/lb

TABLE 2-44

DYEING AND FINISHING – KNITTED FABRICS INDUSTRY GROWTH 1958-1970

	No. Employees		Value Added ($MM)	Cost of Materials ($MM)	Value of Shipments ($MM)	Capital Expenditures ($MM)
	No. (000)	Payroll ($MM)				
1970	48.2	296.2	648.5	1,235.9	1,881.8	85.3
1958	18.4	73.9	147.4	336.1	487.2	7.1

Source: Annual Survey of Manufacturers, Dept. of Commerce.

(k) Cost of Treatment. The cost of treating the wastes of the knit finishing process is presented in Table 2-45.

TABLE 2-45

COSTS FOR BPT AND BAT GUIDELINES – KNITTED FABRICS

	Small	Medium	BPT	BAT
Production (1000 lb/day)	15.0	40	80	120
Water Use (gal/lb)	20	20	20	20
Treatment Plant Size (mgd)	0.3	0.8	1.6	2.4
BOD removed (lb/day)	332	884	1768	2652
BPT for Mills Subject to Normal Guidelines ($1000)				
Capital Investment	117	200	304	397
Annual Costs	35	57	86	111
BPT for Mills Qualifying as Commission Finishers ($1000)				
Capital Investment	119.4	205.3	313.5	410.3
Annual Costs	35.2	57.3	86.5	111.8
BAT (incremental) ($1000)				
Capital Investment	286	452	651	770
Annual Costs	72	118	174	213
BAT (total) ($1000)				
Capital Investment	403	652	955	1163
Annual Costs	107	175	260	324

(l) Potential Impact. The potential impact of compliance with the guidelines is shown in Tables 2-46 and 2-47. Table 2-46 summarizes the impact of Category 5 mills subject to normal guidelines, and Table 2-47 summarizes the impact on Category 5 mills qualifying under the commission finisher exemption.

(m) Passed-on Costs of BAT. The added revenues that the small- and medium-size knit fabric dyeing and finishing mills may expect to generate from increased prices to help defray BAT costs are shown in Table 2-48.

TABLE 2-46

SUMMARY OF IMPACT OF CATEGORY 5 MILLS SUBJECT TO NORMAL GUIDELINES

Category	**(5) Knit Fabric Dyeing and Finishing**	
Total Mills in Category	455	
Total Employment in Category	30,500	
Mill Size	small	medium
Mills Potentially Impacted	3	1
Employees Potentially Impacted	120	100
BPT Expected Impact		
Annual Cash Flow Circa 1977	$96,300- $282,600	$417,200- $1,054,200
Annual Treatment Cost – BPT	$35,000	$57,000
Expected Mill Closings Caused by Implementation of BPT		
Mills	0	0
(Employees)	(0)	(0)
Percent Impact		
Mills 2.6%	0	
(Employees) 1.9%	0	
Production 1.9%	0	
BAT Expected Impact		
Cash Available in 1983 to Defray BAT Treatment Costs* (Equals Annual Cash Flow Plus Incremental Revenues)	$120,000- $330,100	$492,300- $1,180,800
Annual Treatment Costs – BAT	$107,000	$175,000
Mill Closings (After Price Increase) Due to BAT		
Mills	0	0
(Employees)	(0)	(0)
Percentage Impact		
Mills	0	
Employees	0	
Production	0	

* If competitive conditions prevailing in 1983 permit large mills to pass on the incremental cost of BAT as a price increase, then the impact on small and medium sized mills may be reduced as they too pass on a portion of these costs. The proportion that the small and medium mills may pass on is equal to the percentage price increase times their annual sales. The resulting increase in revenues may not cover all incremental BAT treatment costs and some mills may still be impacted.

TABLE 2-47

SUMMARY OF IMPACT OF CATEGORY 5 MILLS QUALIFYING UNDER COMMISSION FINISHER EXEMPTION

Commission Finishers Drawn from Category		(5)	
Total Commission Finishers Drawn from Each Category		76	
Estimated Employment		3900	
Mill Size	small		medium
Mills Potentially Impacted	64		14
Employees Potentially Impacted	2,500		1,400
BPT Expected Impact			
Annual Cash Flow	$98,300-		$417,200-
Circa 1977	$298,800		$1,054,200
Annual Treatment Cost – BPT	$35,000		$57,000
Expected Mill Closings Caused by Implementation of BPT			
Mills	0		0
(Employees)	(0)		(0)
Percent Impact			
Mills 29.0%		0	
Employees 22.9%		0	
Production 22.9%		0	
BAT Expected Impact			
Cash Available	$120,000		$492,300
in 1983 to Defray BAT Treatment	$330,100		$1,180,800
Costs* (Equals Annual Cash Flow Plus Incremental Revenues)			
Annual Treatment Costs	$107,000		$175,000
Expected Mill Closings (After Price Increase) Due to BAT			
Mills	0		0
(Employees)	(0)		(0)
Percent Impact			
Mills		0	
Employees		0	
Production		0	

* If competitive conditions prevailing in 1983 permit large mills to pass on the incremental cost of BAT as a price increase, then the impact on small and medium sized mills may be reduced as they too pass on a portion of these costs. The proportion that the small and medium mills may pass on is equal to the percentage price increase times their annual sales. The resulting increase in revenues may not cover all incremental BAT treatment costs and some mills may still be impacted.

TABLE 2-48

ADDED REVENUE FOR BAT: CATEGORY 5 – KNIT FABRIC DYEING AND FINISHING

Assumed large mill production:	22.0 million pounds/year
Annual incremental operating costs for large mills:	$174,000/year
Incremental price increase/pound that large mills would pass on:	$0.00791
Increased revenues:	
Small mill	$23,700 – $47,500
Medium mill	$75,100 – $126,600

(5) Category 7 – Yarn and Stock – Dyeing and Finishing

(a) General. According to the Census of Manufactures, during 1967 a total of 192 establishments were engaged in the dyeing and finishing of yarn, stock, and narrow fabrics. Yarn dyeing facilities accounted for the bulk of these establishments, estimated at 80% of the total.

Table 2-49 illustrates the relative position of yarn dyeing facilities between 1958 and 1970. During that period, employment increased from 7,800 to 12,300, and value of shipments doubled, and capital expenditures rose from $2.1 million to $13.3 million.

TABLE 2-49

YARN AND STOCK DYEING AND FINISHING INDUSTRY GROWTH 1958-1970

	No. Employees (000's)	Payroll ($MM)	Value Added ($MM)	Cost of Materials ($MM)	Value of Shipments ($MM)	Capital Expenditures ($MM)
Finishing Plants – Yarn: Ratio of concentration, 1967: 4 large, 29%; 8 large, 44%						
1958	7.8	28.8	52.0	105.7	158.0	2.1
1970	12.3	72.9	141.9	206.5	346.3	13.3

Total Plants: 192

Source: Annual Survey of Manufacturers 1970.

(b) Process Description. The raw material for the plants of Category 7 is staple or filament yarn. The yarn may consist of either natural or synthetic fibers or a blend of both. Wet processes used by yarn mills include scouring, bleaching, mercerizing, and dyeing. Yarn dyeing is different from woven fabric dyeing inasmuch as there is no desizing operation. It is different from knit fabric dyeing because its water use is significantly smaller.

Several techniques for processing raw yarn into the finished product are available. The most common process is probably package dyeing, but other processes, such as space dyeing, are widely used as well. In the former process, yarn wound on perforated tubes is placed in a large vessel, which is then sealed. The dye solution is circulated through the yarn at an appropriate temperature. The dyed yarn is then washed, rinsed, and dried. In space dyeing, yarn is knit and the fabric is piece-dyed, washed, rinsed, and dried. The fabric is then unravelled and the yarn is wound onto cones.

Most dyed yarns are used in woven fancy piece goods, Jacquard knits, and carpets, which constitute a strong segment of the current textile market.

Stock-dyed fiber is losing importance. Stock dyeing was used to obtain yarns containing fibers of different shades; i.e., blended from different stock fibers. Use of newly developed specific cationic dyes provides a similar effect in single-bath piece dyeing (after weaving or knitting) at a lower production cost and provides a rapid turnaround of inventories and quickened delivery to the customer.

(c) Number of Establishments and Size Distribution. According to the 1967 Census of Manufactures, 192 establishments were engaged in the dyeing and finishing of yarn, stock, and narrow fabrics. The Census breakdown by size is given in Table 2-50.

TABLE 2-50

YARN AND STOCK DYEING AND FINISHING

Establishments

	No. of Establishments	No. of Employees (000's)
Finishing Own Yarns:		
Total Establishments	129	8.2
Establishments with an average of:		
1 to 4 employees	29	0.1
5 to 9 employees	13	0.1
10 to 19 employees	21	0.3
20 to 49 employees	22	0.7
50 to 99 employees	23	1.7
100 to 249 employees	14	2.1
250 to 449 employees	4	1.3
500 to 999 employees	3	1.9
Commission Finishing – yarn:		
Total Establishments	63	4.2
Establishments with an average of:		
1 to 4 employees	9	–
5 to 9 employees	11	.1
10 to 19 employees	4	.1
20 to 49 employees	18	.6
50 to 99 employees	9	.6
100 to 249 employees	6	1.0
250 to 449 employees	6	1.9

Source: Census of Manufactures, 1967.

Of these 192 mills, 102 are integrated mills which we assumed would not be impacted by compliance with the guidelines.

The remaining 90 mills are non-integrated, and we assumed them to be prone to impact.

Of these 90 mills, we estimated that 26 were non-commission mills by the definition of commission mills used in this study. These 26 mills are estimated to be composed of 22 small mills and 4 medium mills, based on the 1967 Census ratio of mills employing 50 to 100 compared to those mills employing less than 50.

We estimated that the remaining 64 commission mills were composed of 53 small mills and 11 medium-sized mills, again using the Census ratio.

The above distribution of mills is shown in Figure 2-5.

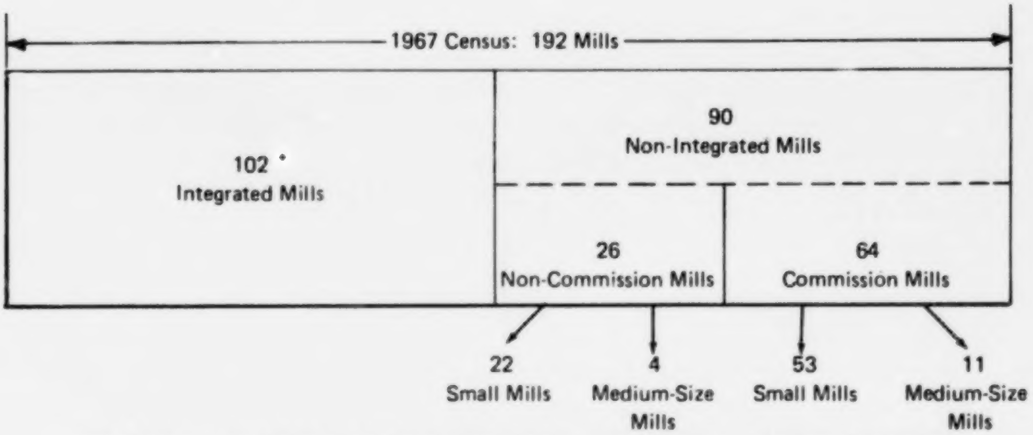
1967 Census: 192 Mills
102 *
Integrated Mills
90
Non-Integrated Mills
26
Non-Commission Mills
64
Commission Mills
22
Small Mills
4
Medium-Size Mills
53
Small Mills
11
Medium-Size Mills

FIGURE 2-5 NUMBER OF ESTABLISHMENTS: CATEGORY 7 – STOCK AND YARN DYEING AND FINISHING

(d) Number of Employees. The number of employees in this category, and those potentially impacted, based on the average employment in the representative mills, are shown in Table 2-51.

(e) Types of Plants. As we have illustrated in Table 2-49, major capital investment has occurred in the last 10 years, which is reflected in the relatively modern equipment in the establishments that are of large size. Small establishments are fragmented and equipment is not up to date.

(f) Geographic Distribution. Table 2-52 gives the geographic distribution of yarn finishing plants. Of a total of 192 plants in the United States the majority is in the northeastern region, where there are 121 plants or two-thirds of the total, and 57 plants or one-third are located in the southern region.

TABLE 2-51

NUMBER OF EMPLOYEES: CATEGORY 7 – STOCK AND YARN DYEING AND FINISHING

			No. of Employees
64 Commission mills			1,860
Composed of 53 small mills:	1,200		
and 11 medium mills:	660		
128 Non-commission mills			8,300
Composed of 22 small mills:	500		
4 medium mills:	240		
102 integrated mills:	7,560		
		Total	10,160

(g) Level of Integration. The level of integration between integrated yarn dyers and independent commission yarn dyers is presented below:

(1) Integrated Yarn Dyers. Integrated yarn dyers are composed of two distinct types:

(a) Divisions of the large integrated weaving mills that own their own spinning and texturizing facilities and utilize their own yarn-dyeing facilities to finish the output of their spinning and texturizing mills. Dyed yarn is then sold to outside customers or used internally.

(b) Independent yarn spinners and texturizers that have their own dyeing facilities and produce yarn only, which in turn is dyed in their own facilities and sold outside.

In both cases, the dyeing facility could be used to do commission dyeing for outside customers in addition to its own requirements.

We estimate that out of a total of 192 establishments, 102 are parts of independent yarn producers or integrated textile companies.

(2) Commission Yarn Dyers. Commission yarn dyers are independent plants that perform a serivce function only. The larger ones purchase yarn and sell dyed yarns to their customers; the smaller ones simply perform the function of commission dyeing.

TABLE 2-52

YARN AND STOCK DYEING AND FINISHING*

(Geographic Distribution)

	No. of Establishments				With 20 or More Employees			
Finishing Plants – Yarn:								
United States	192				105			
Northeastern Region		121				53		
New England Division			18				13	
Massachusetts				10				8
Rhode Island				7				5
Middle Atlantic Division			103				40	
New York				42				14
New Jersey				39				15
Pennsylvania				22				11
North Central Region		7				4		
East North Central Division			6				4	
Ohio				1				1
Illinois				2				1
Michigan				1				1
Wisconsin				2				1
Southern Region		57				45		
South Atlantic Division			46				39	
Virginia				2				2
North Carolina				35				29
South Carolina				4				3
Georgia				4				4
East South Central Division			10				6	
Tennessee				7				4
Alabama				3		3		2
Western Region		7					3	
Pacific Division			7					3
California				7				

Sources: Census of Manufactures 1967, ADL estimates and industry listings.

*The subtotals do not add up to the totals, in all cases, since all geographic areas are not necessarily included.

We estimate that out of a total of 192 establishments, 80 to 90 are independent yarn dyers and this would also account for the discrepancy in ratios illustrated according to the Census of Manufactures in Table 2-53.

(h) Types of Products. The dyeing of stock and yarn is a limited, specialized operation, solely limited to imparting color to both filament and staple yarns, predominantly in cotton and synthetic fibers.

TABLE 2-53

FINISHING PLANTS, YARN AND STOCK

(Size Distribution by Number of Employees)

	No. of Establishments	No. of Employees (000's)
Finishing Own Yarns:	129	8.2
Commission Finishing:	63	4.2

Source: Census of Manufactures 1967

(i) Financial Profile. No financial structure for independent commission yarn dyers is available. We therefore feel that representative financial structures are expressed in the category of integrated yarn manufacturing and dyeing as illustrated in Table 2-54.

A major capital investment has occurred in the last 10 years, which is reflected in the relatively modern equipment in the larger establishments. Small mills are fragmented and equipment is not up to date.

(j) Composite Mill. A representative small mill dealing in this category might be a northern yarn mill with some of its buildings dating from the late 1800's with newer sections built in the 1920's, and then modified in the 1950's. Some production equipment might be 30 years old with some pressure dye kettles being less than 5 years old. The average age of the equipment might range from 8 to 10 years.

A representative medium sized mill might be an urban-type mill located in one of the mid-Atlantic states. This mill would likely be a commission dye house which buys its own yarn, dyes it, and then sells it to its customers (formerly the customer owned the yarn). Thus the mill would have appreciable capital tied up in yarn inventory. The age of its equipment would vary considerably, as with the small mills, with some of its machines being 30 or more years old and some relatively new, since the medium sized mills generally have a regular capital improvement program.

The medium sized mill would likely process both synthetic and natural fibers, including wool, but it would not likely have space for treatment facilities. Any treatment required would have to be performed in some of its present production or warehouse space, as they may be space-limited. Table 2-55 presents typical ranges of the various business facets of the small- and medium-size mills involved in Category 7 operations, and of a large mill to help establish the level of 1983 treatment costs that may be able to be passed on.

TABLE 2-54

FINANCIAL PROFILE

(Yarn Spinning and Dyeing)

	Dixie Yarns	National Spinning Company	Standard Coosa-Thatcher	Burkyarns Inc.
Net Sales ($MM)				
1970	87	75	50	17
1971	99	76	53	22
Net Profit ($MM)				
1970	1.7	2.1	1.9	0.9
1971	2.3	1.9	1.7	1.3
Profit Margin				
1970	2.0%	2.8%	3.8%	5.3%
1971	2.3%	2.5%	3.2%	5.9%
Return on Equity				
1970	6%	9%	7%	25%
1971	7%	8%	6%	24%
Return on Investment				
1970	5%	9%	6%	15%
1971	7%	8%	5%	15%
Capital Expenditures ($MM)				
1970	3	4	3	3
1971	–	2	6	2

Source: Based on Company Annual Reports

(k) Cost of Treatment. The cost of treatment for the wastes involved in the stock and yarn dyeing process is shown in Table 2-56.

(l) Potential Impact. The potential impact of compliance with the guidelines is shown in Tables 2-57 and 2-58.

(m) Passed-on Costs of BAT. Added revenues that the small- and medium-size stock and yarn dyeing and finishing mills may expect to generate from increased prices to help defray BAT costs are shown in Table 2-59.

TABLE 2-55

REPRESENTATIVE SMALL- AND MEDIUM-SIZE STOCK AND YARN DYEING MILLS

	Small	Medium	Large
Sales	$916,400 – $2,687,500	$2,687,500 – $5,375,000	$6,700,000
Profit (before taxes)	$0 – $134,400	$107,500 – $322,500	$270,000-$400,000
	0 – 5%	4 – 6%	4-6%
Profit (after taxes)	$0 – $76,400	$62,400 – $174,200	$147,000-$215,000
	0 – 2.8%	2.3 – 3.2%	2.2-3.2%
Depreciation	$64,000 – $138,100	$188,100 – $376,250	$470,000
Debt Repayment	Not Known	Not Known	Not Known
Cash Flow	$64,000 – $264,500	$250,500 – $550,500	$617,000-$685,000
Salvage	$229,100 – $671,900	$671,900 – $1,343,750	$1,700,000
Cost Structure			
Fixed	$202,500 – $593,750	$593,400 – $1,175,000	$1,500,000
	23%	23%	23%
Variable	$668,100 – $1,959,400	$1,986,600 – $3,877,500	$5,000,000
	77%	77%	77%
Production	1,705,000 – 5,000,000 lb/yr	5,000,000 – 10,000,000 lb/yr	12,480,000 lb/yr
	6,820 – 16,000 lb/day	16,000 – 32,000 lb/day	40,000 lb/day
Employment	20 – 40	40 – 80	100
Work Week	5 day, 3 shift	5-6 day, 3 shifts	5-6 day, 3 shifts
Water Use	52.5 – 123 MGY	52.5 – 246 MGY	275 MGY
	0.15 – 0.35 MGD	0.15 – 0.70 MGD	0.9 MGD
	22 gal/lb	22 gal/lb	22 gal/lb

TABLE 2-56

COSTS FOR BPT AND BAT GUIDELINES – STOCK AND YARN DYEING

	Small	Medium	BPT	BAT
Production (1000 lb/day)	11	24	40	60
Water Use (gal/lb)	22	22	22	22
Treatment Plant Size (mgd)	0.23	0.53	0.88	1.32
BOD removed (lb/day)	520	1040	1732	2598
BPT for Mills Subject to Normal Guidelines ($1000)				
Capital Investment	110	170	227	293
Annual Costs	33	49	65	83
BPT for Mills Qualifying as Commission Finishers ($1000)				
Capital Investment	111.2	172.2	230.2	297.6
Annual Costs	33.05	49.1	65.2	83.3
BAT (incremental) ($1000)				
Capital Investment	256	372	473	574
Annual Costs	64	95	124	153
BAT (Total) ($1000)				
Capital Investment	366	542	700	867
Annual Costs	97	144	189	236

TABLE 2-57

SUMMARY OF IMPACT ON CATEGORY 7 MILLS SUBJECT TO NORMAL GUIDELINES

Category	**(7) Stock and Yarn Dyeing Mills**		
Total Mills in Category		128	
Total Employment in Category		8,300	
Mill Size	small		medium
Mills Potentially Impacted	22		4
Employees Potentially Impacted	500		240
BPT Expected Impact			
Annual Cash Flow Circa 1977	$64,000- $264,500		$250,500- $550,500
Annual Treatment Cost – BPT	$33,000		$49,000
Expected Mill Closings Caused by Implementation of BPT			
Mills	0		0
Employees	(0)		(0)
Percent Impact			
Mills		0	
Employees		0	
Production		0	
BAT Expected Impact			
Cash Available in 1983 to Defray BAT Treatment Costs* (Equals Annual Cash Flow Plus Incremental Revenues)	$83,300- $321,000		$307,000- $663,500
Annual Treatment Costs – BAT	$97,000		$144,000
Mill Closings (After Price Increase) Due to BAT			
Mills	1		0
(Employees)	(23)		(0)
Percent Impact			
Mills		0.8	
Employees		0.3	
Production		0.3	

* If competitive conditions prevailing in 1983 permit large mills to pass on the incremental cost of BAT as a price increase, then the impact on small and medium sized mills may be reduced as they too pass on a portion of these costs. The proportion that the small and medium mills may pass on is equal to the percentage price increase times their annual sales. The resulting increase in revenues may not cover all incremental BAT treatment costs and some mills may still be impacted.

TABLE 2-58

SUMMARY OF IMPACT FOR CATEGORY 7
MILLS QUALIFYING UNDER COMMISSION FINISHER EXEMPTION

Commission Finishers Drawn from Category			(7)	
Total Commission Finishers Drawn from Each Category			64	
Estimated Employment			1860	
Mill Size		small		medium
Mills Potentially Impacted		53		11
Employees Potentially Impacted		1200		660
BPT Expected Impact				
Annual Cash Flow Circa 1977		$64,000- $264,500		$250,500- $550,500
Annual treatment cost – BPT		$33,000		$49,000
Expected Mill Closings Caused by Implementation of BPT				
Mills		0		0
(Employees)		(0)		(0)
Percent Impact				
Mills	29.0%		0	
Employees	22.9%		0	
Production	22.9%		0	
BAT Expected Impact				
Cash Available in 1983 to Defray BAT Treatment Costs* (Equals Annual Cash Flow Plus Incremental Revenues)		$83,300- $321,000		$307,000- $663,500
Annual Treatment Costs		$97,000		$144,000
Expected Mill Closings (After Price Increase) Due to BAT				
Mills		0		0
(Employees)		(0)		(0)
Percent Impact				
Mills			0	
Employees			0	
Production			0	

* If competitive conditions prevailing in 1983 permit large mills to pass on the incremental cost of BAT as a price increase, then the impact on small and medium sized mills may be reduced as they too pass on a portion of these costs. The proportion that the small and medium mills may pass on is equal to the percentage price increase times their annual sales. The resulting increase in revenues may not cover all incremental BAT treatment costs and some mills may still be impacted.

TABLE 2-59

ADDED REVENUE FOR BAT: CATEGORY 7 – STOCK AND YARN DYEING AND FINISHING

Assumed large mill production:	11 million pounds/year
Annual incremental operating costs for large mills:	$124,000
Incremental price increase/pound that large mills would pass on:	$0.0113
Increased revenues:	
Small mill	$19,300 – $56,500
Medium mill	$56,500 – $113,000

APPENDIX

WASTE TREATMENT MODEL FOR TEXTILE EFFLUENT GUIDELINES

1. INTRODUCTION

The waste water treatment technology and raw waste loads that were used as the basis for developing costs as an input to *The Economic Analysis of Effluent Guidelines: Textile Industry* are derived from EPA-440/1-74-0222, Development Document for Effluent Limitations Guidelines and New Source Performance Standards for the Textile Mills Point Source Category, dated June 1974. Pollution limitations in the treated effluent are described in The Federal Register, Volume 39, Number 130, Part II, dated July 5, 1974, and entitled "Environmental Protection Agency Textile Industry Point Source Category, Effluent Guidelines and Standards."

The proposed Level I guidelines (BPT) are based primarily on secondary biological treatment. The BOD levels proposed by EPA are assumed to be met by extended biological treatment which also reduces COD. But, by definition, COD consists essentially of refractory organic compounds which are not degraded readily by biological treatment. The available data on COD reduction in a biological system and the ultimate effluent levels which can be achieved are quite limited. For some plants, this level of treatment alone may not be adequate to meet Level I guidelines and tertiary treatment may be required. Level II guidelines (BAT) are also based on secondary biological treatment with the addition of lime treatment and multimedia filtration to further reduce COD in some plants, and treatment by activated carbon may prove advantageous.

To reflect the very different treatment economics between small, medium and large plants, we have developed costs for three or four plant sizes in each industry category (except Category 1). Treatment plant size is based on actual production and the assumed water use (gal/lb product) from the EPA guidelines for that category. We have made no allowance for increased in-plant costs to reduce water use, where plants have a higher water use rate than the assumed value for that category.

The calculated capital and annual investment costs for the mills in each category are plotted in Figures A-1 to A-5 as a function of production rate for *total* BPT and BAT treatment requirements. A sufficiently linear relationship exists to allow interpolation for plants which have an intermediate production rate.

Information on actual treatment cost experience in the textile industry was available from the Development Document and its backup data in varying degrees of completeness from the exemplary plants visited. To verify the quality of the data received and to provide a broader basis for estimation, a costing model was developed based on standard waste water treatment practice. This model covers both capital and operating costs for

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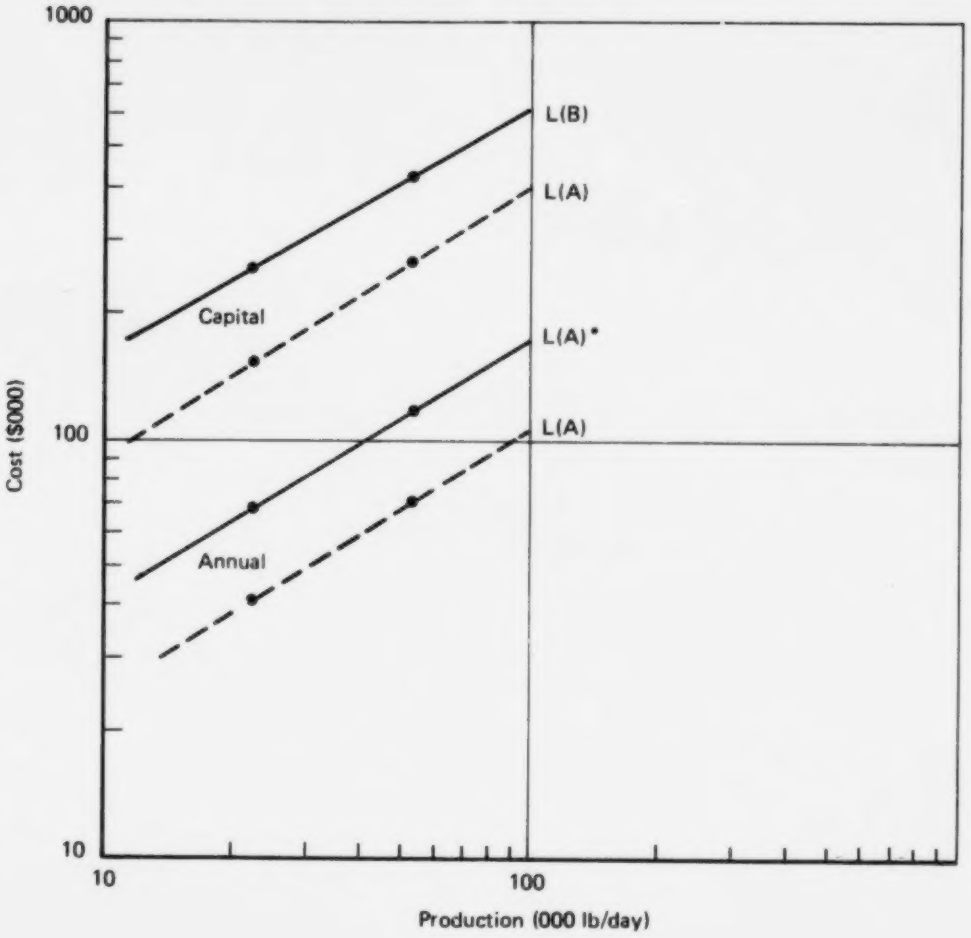
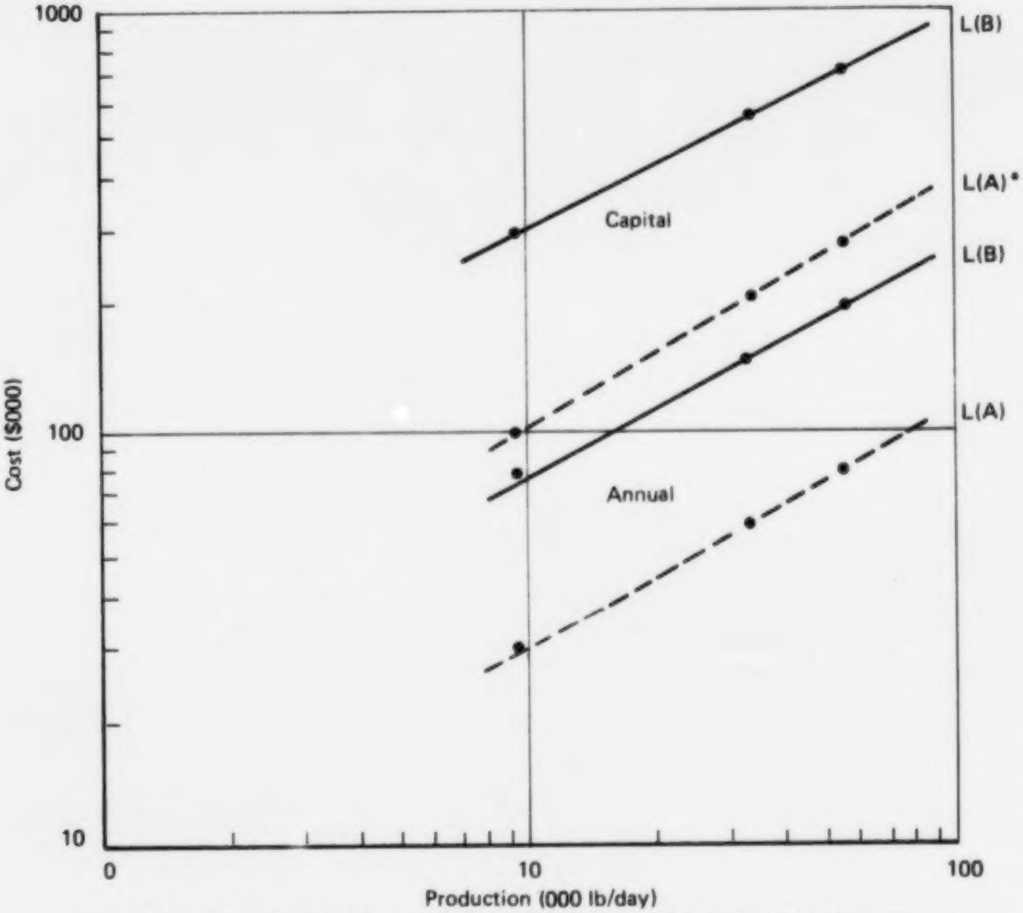


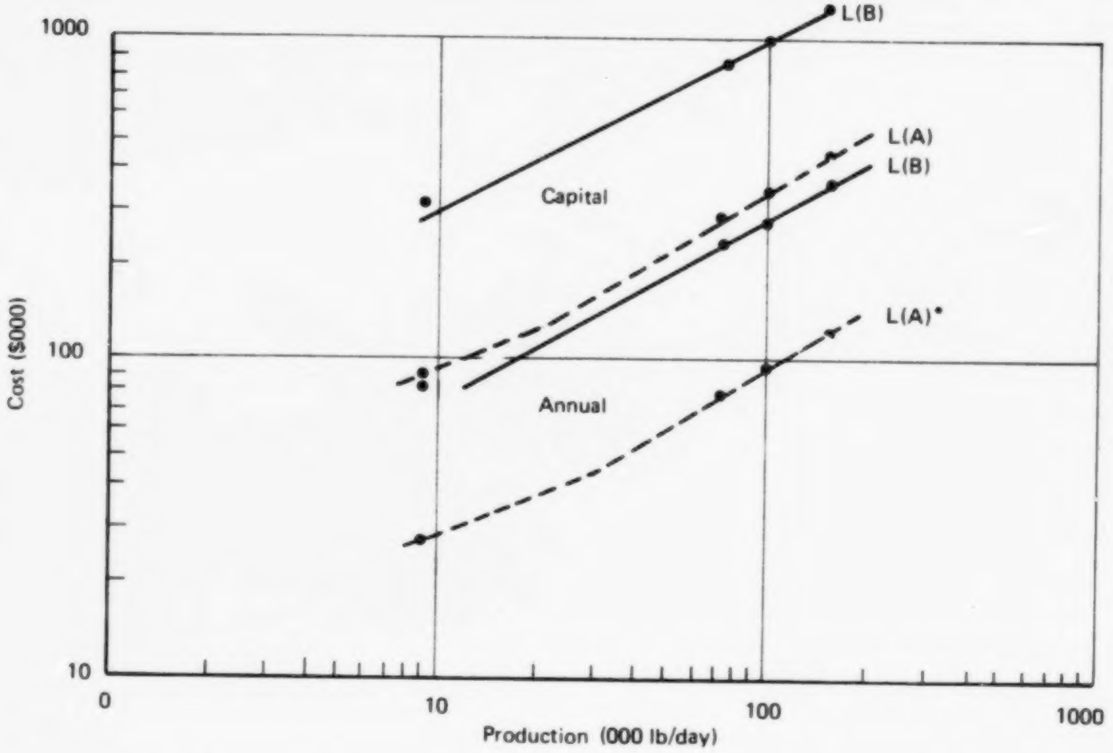
*Two mills – (A) and (B) – were selected to provide a range of costs for large mills. Large mill (A) was used to calculate additional revenues to meet BAT guidelines.

FIGURE A-1 CATEGORY 1 – WOOL SCOURING



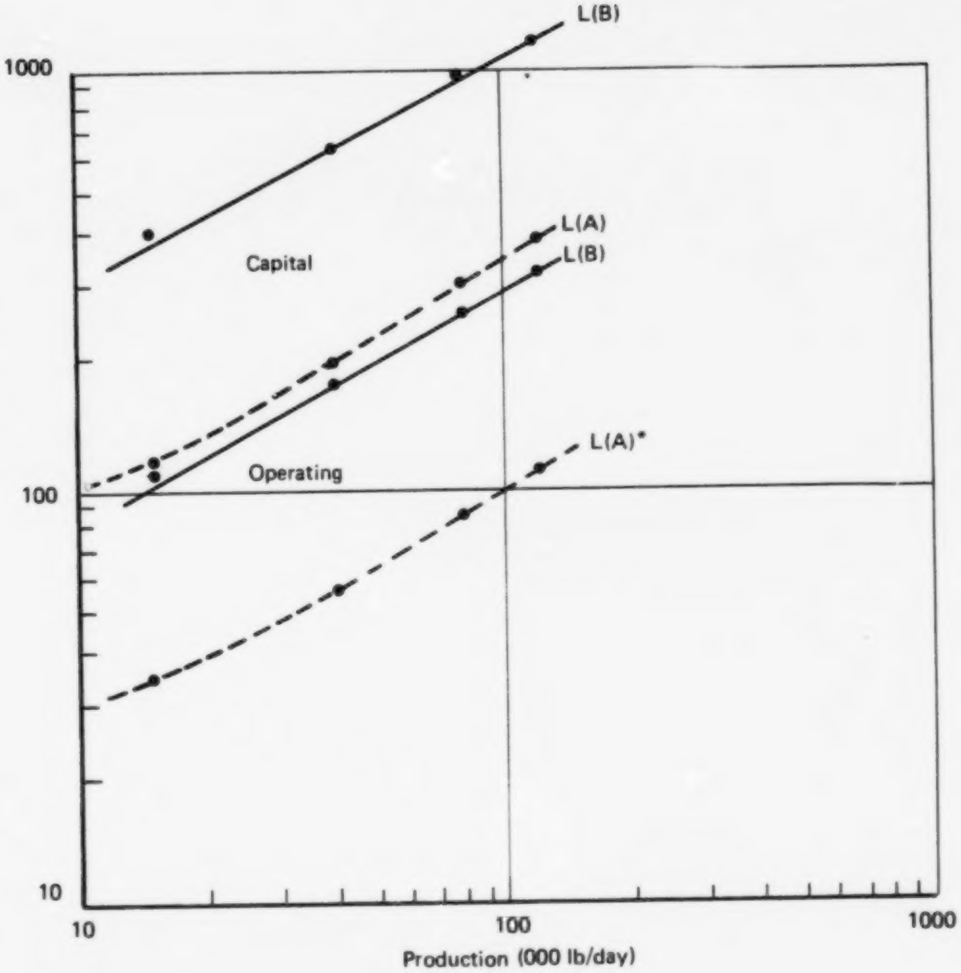
*Two mills –(A) and (B) – were selected to provide a range of costs for large mills. Large mill (A) was used to calculate additional revenues to meet BAT guidelines.

FIGURE A-2 CATEGORY 2 – WOOL FINISHING



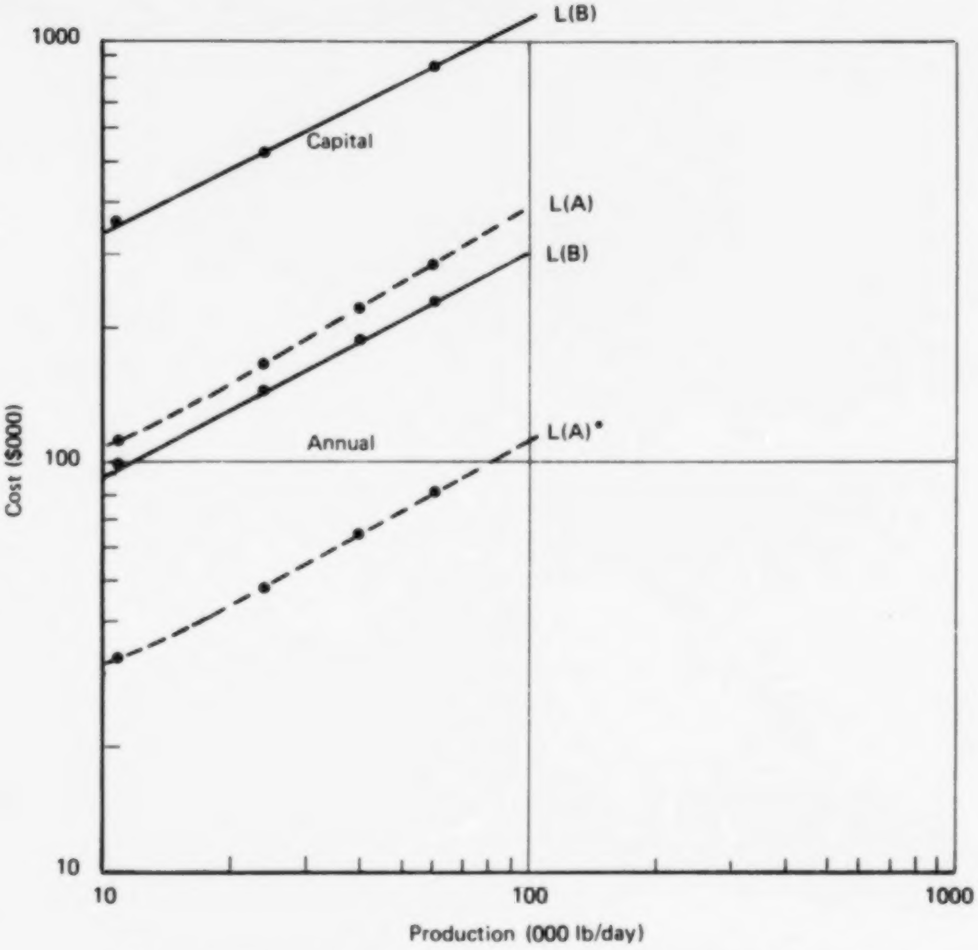
*Two mills – (A) and (B) – were selected to provide a range of costs for large mills. Large mill (A) was used to calculate additional revenues to meet BAT guidelines.

FIGURE A-3 CATEGORY 4 – WOVEN FINISHING



*Two mills – (A) and (B) – were selected to provide a range of costs for large mills. Large mill (A) was used to calculate additional revenues to meet BAT guidelines.

FIGURE A-4 CATEGORY 5 – KNIT FINISHING



*Two mills – (A) and (B) – were selected to provide a range of costs for large mills. Large mill (A) was used to calculate additional revenues to meet BAT guidelines.

FIGURE A-5 CATEGORY 7 – STOCK AND YARN DYEING the equivalent of what appears to be the best technology currently practiced by the industry: essentially primary and secondary treatment with extended aeration and lagoons. Over a plant size range of 400-12,000 cubic meters per day (0.1 to 3.0 mgd) the cost experience data from the plants visited came within ±30 percent of that predicted by the cost model. The costs calculated from the model, therefore, are believed to be realistic bases for estimating the (replacement) value of existing facilities and the economic impact of further secondary-type treatment requirements.

The cost data used were derived from varied industrial and municipal applications. They are adjusted where possible to reflect specific changes necessary for the textile industry. Costs have been adjusted to the national average cost level of 1973, using the ENR Construction Cost Index, and do not include unusual construction or site-specific requirements. The curves include all elements of construction cost which a contract bidder would normally encounter in completing the waste water treatment, such as building materials, labor, equipment, electrical, heating and ventilation, normal excavation and other similar items. Also included are the engineering costs. The annual costs include operation and maintenance labor, chemicals, power, materials and supplies, depreciation, and taxes and insurance.

2. BEST PRACTICABLE TREATMENT TECHNOLOGY (LEVEL I)

The Best Practicable Treatment (BPT) technology in this industry is considered to be the end-of-pipe treatment steps shown in Figure A-6. The initial capital cost of biological treatment systems depends mainly upon the hydraulic load, the other factors making only minor variations in the total cost. Operating and maintenance labor, materials and supplies, and chemicals are also functions of hydraulic loads. Power requirements are primarily a function of pollutant load. Cost curves to calculate each of these cost elements as a function of plant size (or production) have been described and are appropriately identified with each of the specific cost elements described in detail below.

a. Capital Cost Elements

(1) Primary Treatment. Primary screening consists of grit removal and flow measurement as a means of protecting subsequent facilities from excessive wear and deposition of grit, including pH control, screening, and coagulation. Costs include flow channels and super-structures, grit handling equipment, electrical, heating, ventilating, and auxiliary equipment as required (see Figure A-7). Primary clarification is included as additional primary treatment for wool scouring only. Capital costs are obtained from Figure A-8.

(2) Aerated Stabilization Basin System. The lagoons are sized for a given retention time (determined on the basis of available treatability data) with a depth of 7 feet. These data were extended to the higher inlet and lower effluent BOD levels by assuming constant ratios of biological characteristics to be applicable over the entire range. Costs

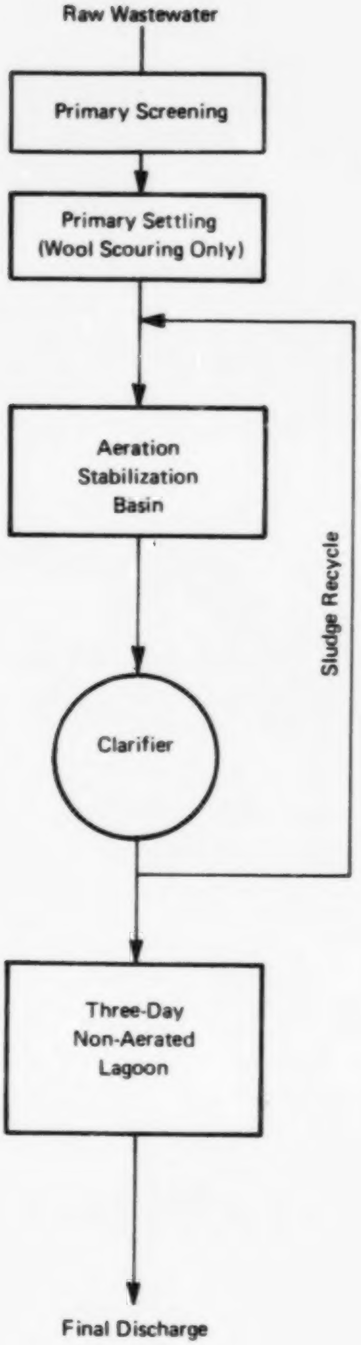

Raw Wastewater
Primary Screening
Primary Settling (Wool Scouring Only)
Aeration Stabilization Basin
Sludge Recycle
Clarifier
Three-Day Non-Aerated Lagoon
Final Discharge

FIGURE A-6 SCHEMATIC FLOW DIAGRAM OF PROCESS STEPS AND COST CENTERS FOR LEVEL I TREATMENT

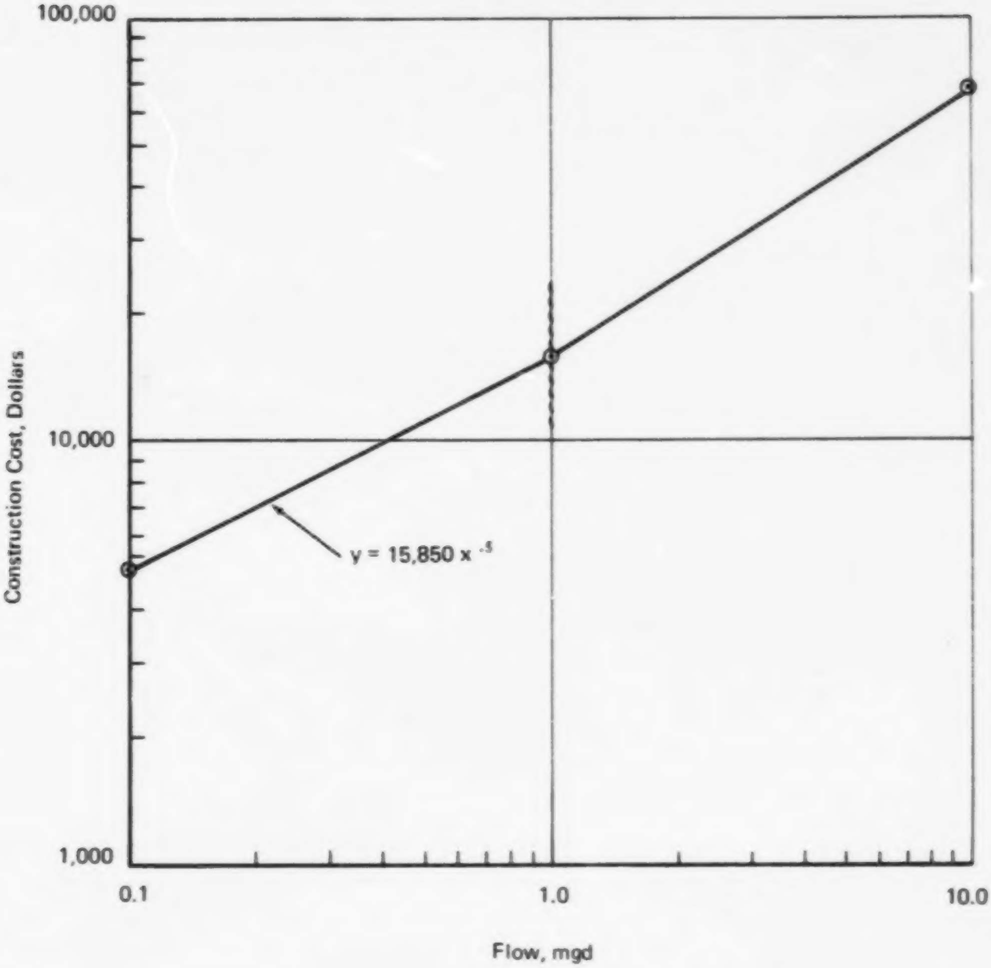


FIGURE A-7 PRIMARY SCREENING PRIOR TO MUNICIPAL TREATMENT (CONSTRUCTION COST)

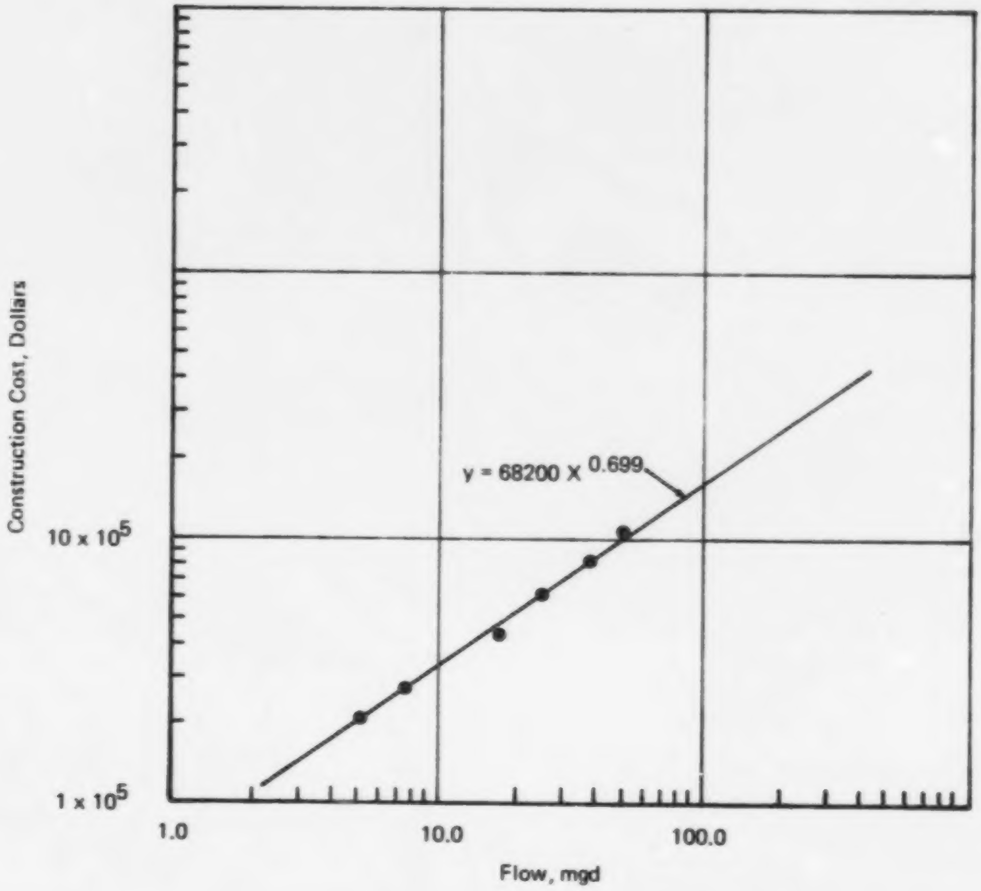


FIGURE A-8 CLARIFIER CAPITAL COST

include lagoon construction, access road, outfall sewer, fencing, seeding, and other construction work, but exclude aeration equipment (see Figure A-9). The costs of aeration equipment are based upon mechanical surface aeration equipment sized on the basis of 50-lb BOD_5 per horsepower-day. Good design practice dictates that total requirements be divided between two or more aerator units. In addition, a complete spare unit is provided. Costs include the aerator motor, gearbox, impeller, draft tube, supporting structure, and applicable electrical work (see Figure A-10).

The sludge lagoons are sized for 5-months' retention with an 8-inch depth. Sludge production is small (0.2 sludge/lb BOD_5 removal and 1 lb sludge/lb suspended solids removal). Costs include normal excavation, dike construction, and sludge distribution piping. Sludge pumps are designed for periodic operation only.

(3) Clarification. Basin construction costs are related to surface area, since the range of normal liquid depths is relatively small. These costs generally decrease as the basin size is increased. It is considered good practice to provide at least two independently operated basins. The size is based upon an overflow rate of 600 gpd/ft^2 and a depth of 12 feet. Costs include all necessary excavation, backfill, concrete, mechanical and electrical equipment, piping, and other work related to the basin construction (see Figure A-8).

(4) Non-Aerated Lagoon. The lagoon is sized for a 3-day retention time with a depth of 7 feet. Costs include lagoon construction, access road, outfall sewer, fencing, seeding, and other construction work (see Figure A-11).

(5) Other Contributions to Capital Cost

(a) Yardwork. The cost of a treatment plant also includes costs of general site clearing and grading, intercomponent piping, lighting, control structures, road paving, and other items outside the structural confines of an individual plant component. These items are commonly called yardwork and are included in the construction cost as an additional 15% of the total construction cost of the individual steps.

(b) Engineering Costs. Engineering costs are based upon the total construction cost, including yardwork and are estimated from Figure A-12.

(c) Land Requirements. Land requirements have not been included in the initial capital investment. Typically mills do not include this cost in their total cost of waste treatment. However, land is a legitimate cost factor to the extent that textile mills have to buy new land for waste water treatment, especially in urban areas. The costs developed here are therefore biased on the low side.

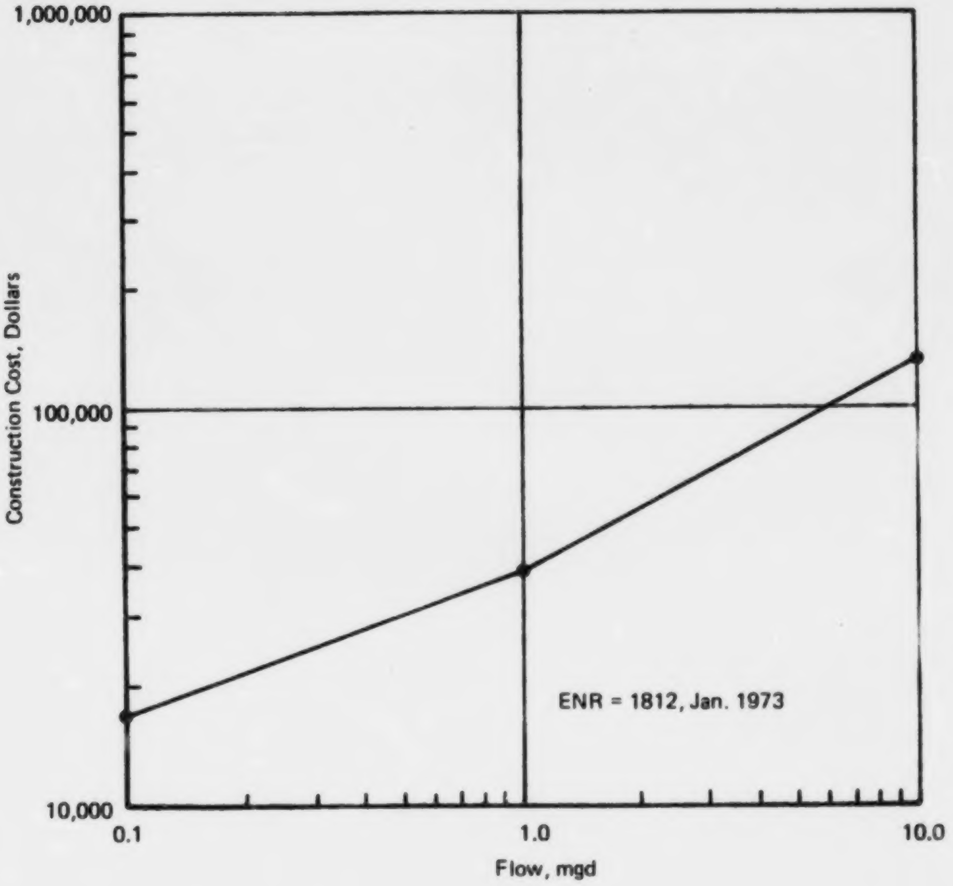


FIGURE A-9 AERATED STABILIZATION BASIN CONSTRUCTION COST

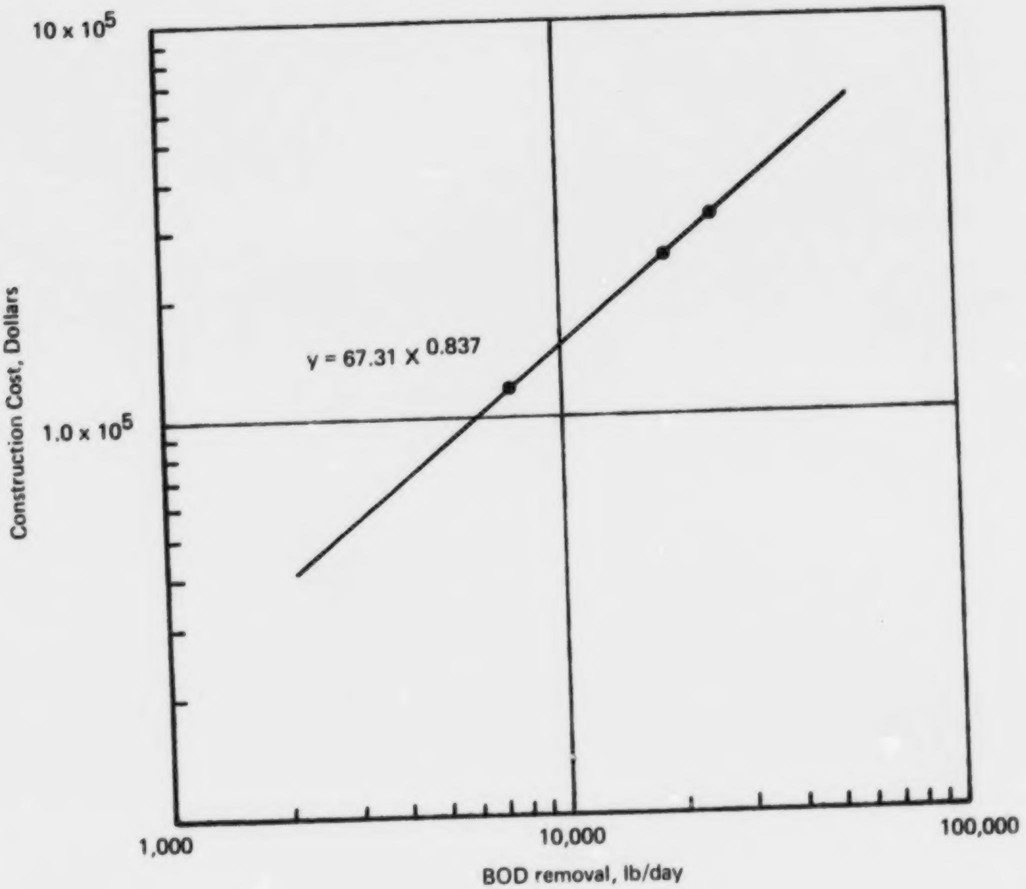


FIGURE A-10 **AERATION EQUIPMENT**
(Aerated Stabilization Basin)

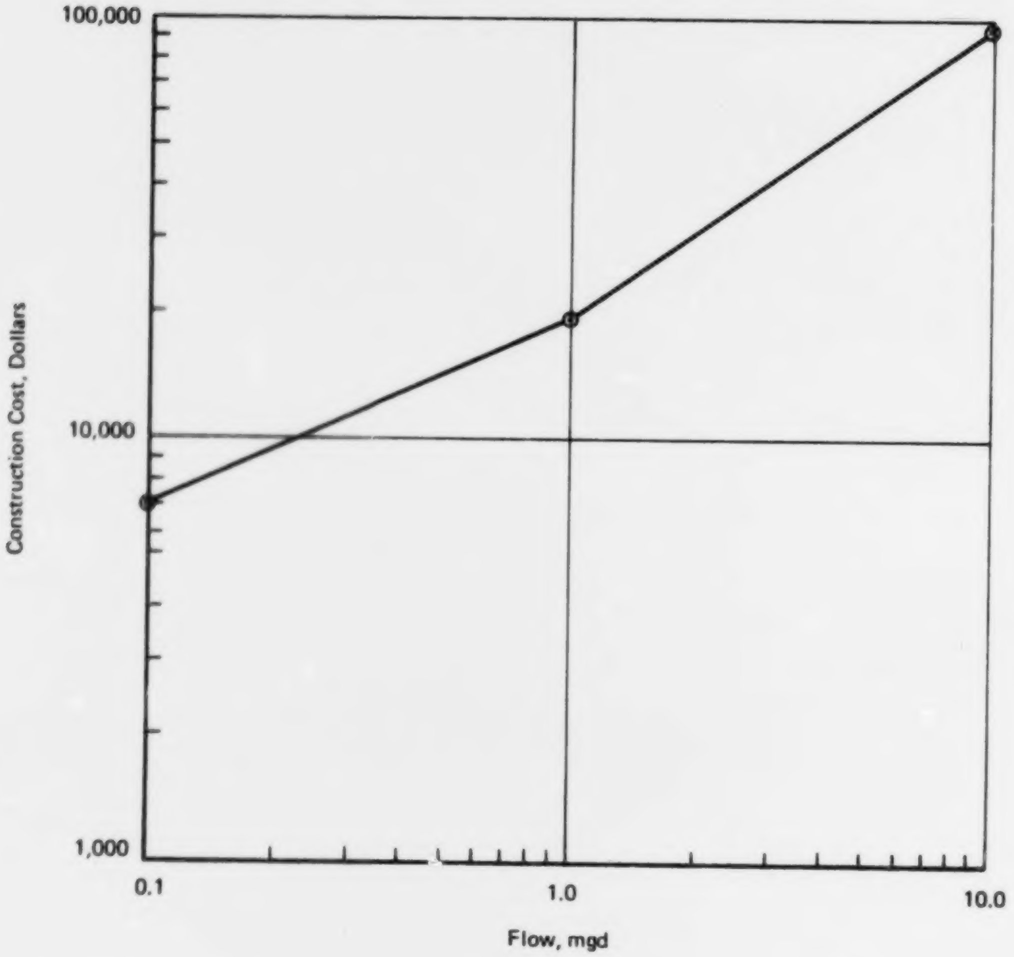


FIGURE A-11 CONSTRUCTION COST – THREE-DAY NON-AERATED LAGOON

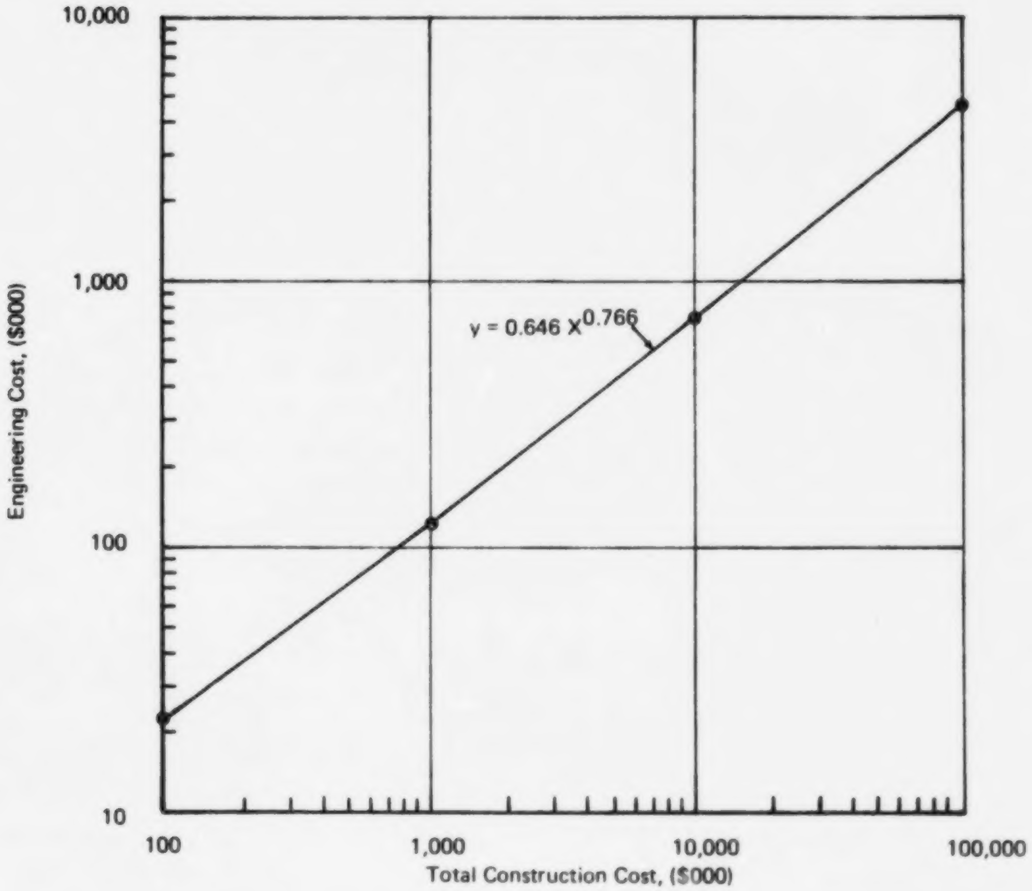


FIGURE A-12 ENGINEERING COSTS

b. Annual Cost Elements

(1) Operation and Maintenance Labor. The annual labor requirements are related, where appropriate, to the same sizing parameters used for construction cost estimates. Requirements were based upon a man-year consisting of 52 weeks at 40 hours per week, or a total of 2080 hours per year. Thus:

Operation man-hours x \$5/hr = direct operation labor cost,

Maintenance man-hours x \$5/hr = direct maintenance labor cost.

Labor costs are associated with primary screening (Figure A-13), primary clarification (Figure A-14), aerated stabilization basin (Figure A-15), and the secondary clarifier (also Figure A-14).

(2) Material and Supply Costs. Material and supply costs (all of the operation and maintenance items, excluding chemicals and power) are related, where appropriate, to the same sizing parameters used for construction costs. Material and supply costs are associated with primary screening (Figure A-16), primary clarification (Figure A-17), aerated stabilization basin (Figure A-18), and secondary clarification (also Figure A-17).

(3) Chemical Costs. These are in addition to the other material and supply costs; that is:

(a) pH Control:

Lime	\$24/ton
Sulfuric Acid	\$34/ton

(b) Sedimentation Aids. It is assumed that only polyelectrolytes (at 0.5 ppm) will be used in the clarifiers to aid the sedimentation step. Several combinations of polyelectrolytes, alum, and ferric chloride are commonly used. These costs are:

Polyelectrolytes	\$1.25/pound.
Ferric chloride	\$0.04/pound.

(c) Nutrients. Nutrients will be added to the aerated stabilization basins as follows: nitrogen at 0.16 lb/20 lb BOD, and phosphorus at 0.1 lb/100 lb BOD.

Ammonia (25%)	\$32.50/ton
Phosphoric Acid (72%)	\$82.80/ton

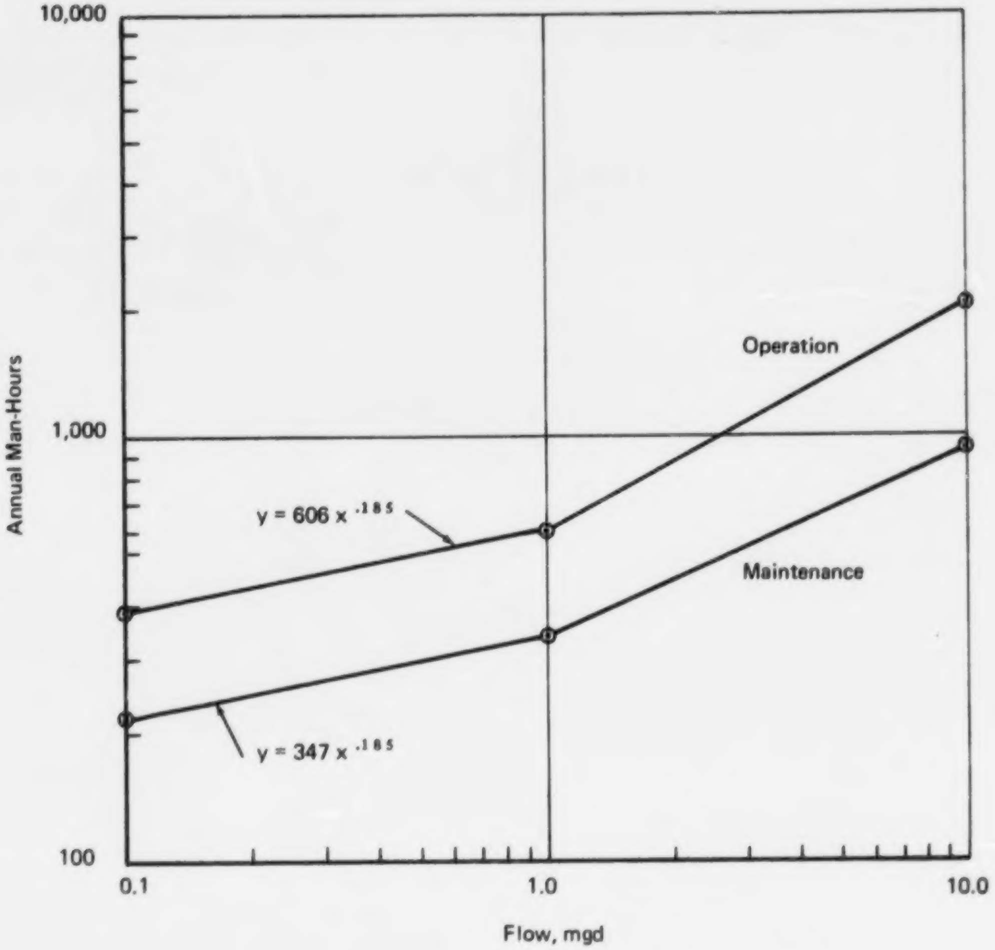


FIGURE A-13 PRIMARY SCREENING – ANNUAL OPERATING AND MAINTENANCE LABOR

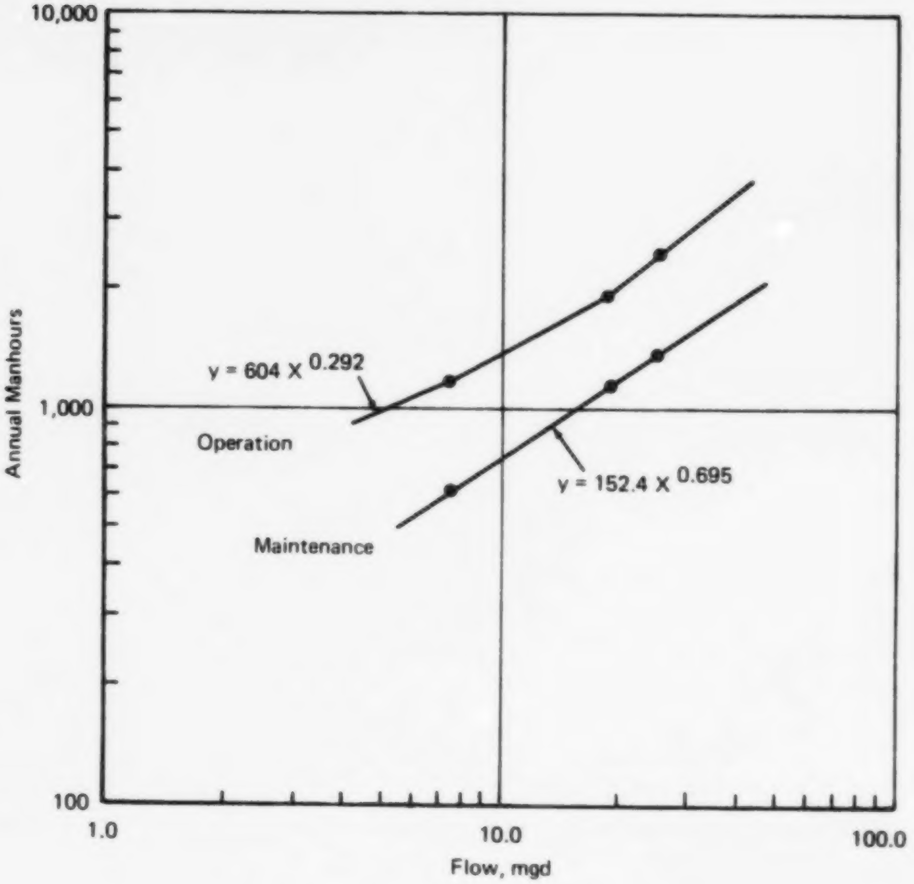


FIGURE A-14 CLARIFIER, ANNUAL OPERATION AND MAINTENANCE LABOR

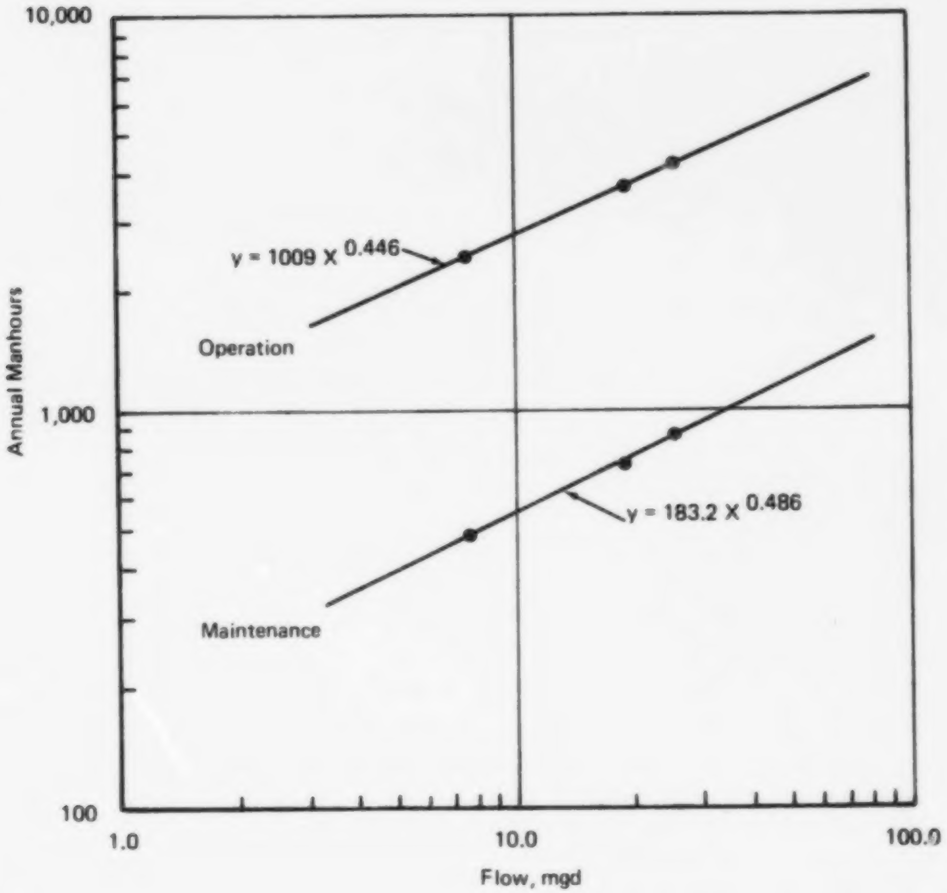


FIGURE A-15 AERATED STABILIZATION BASIN ANNUAL OPERATION AND MAINTENANCE LABOR

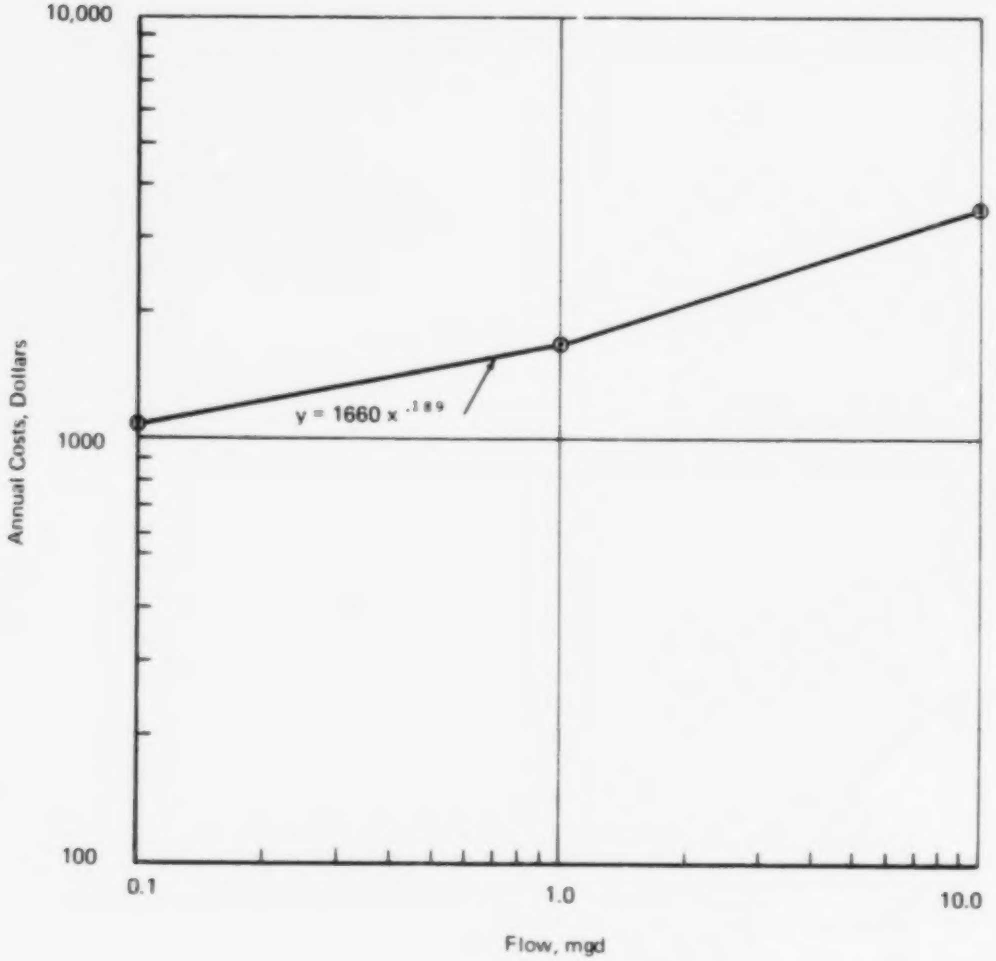


FIGURE A–16 PRIMARY SCREENING–
ANNUAL MATERIAL AND SUPPLY COSTS

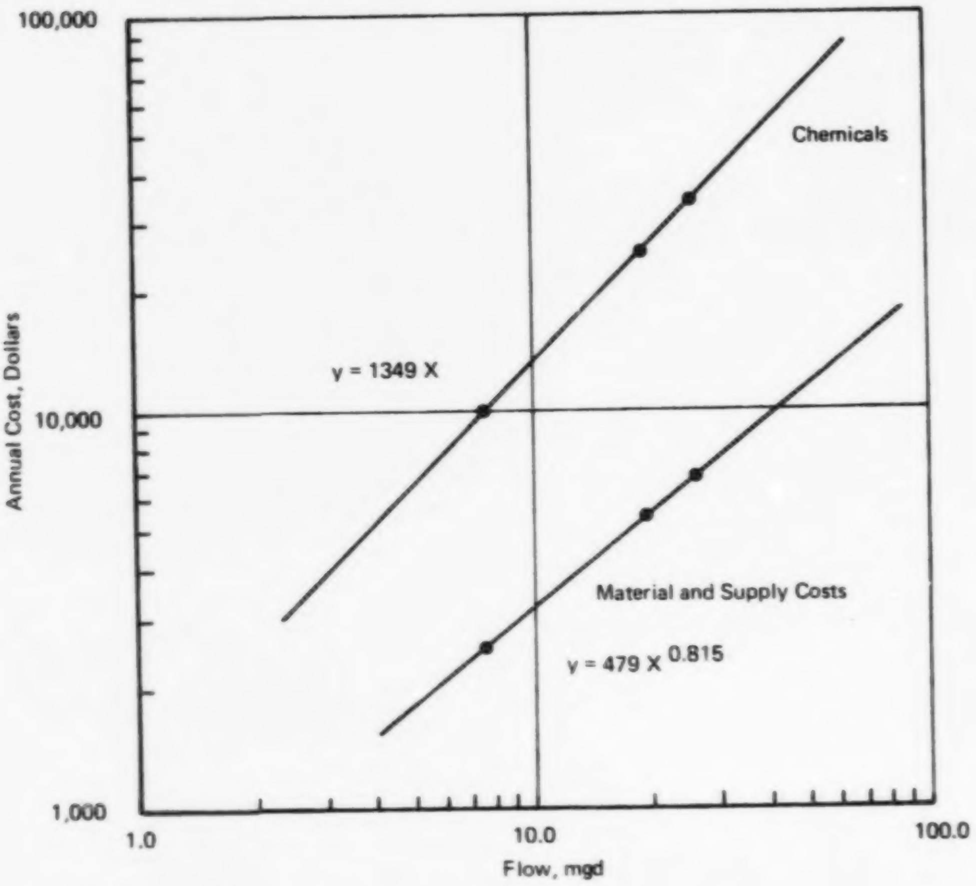


FIGURE A-17 **CLARIFIER**

1. **Material and Supply Costs**
2. **Major Chemical Costs**

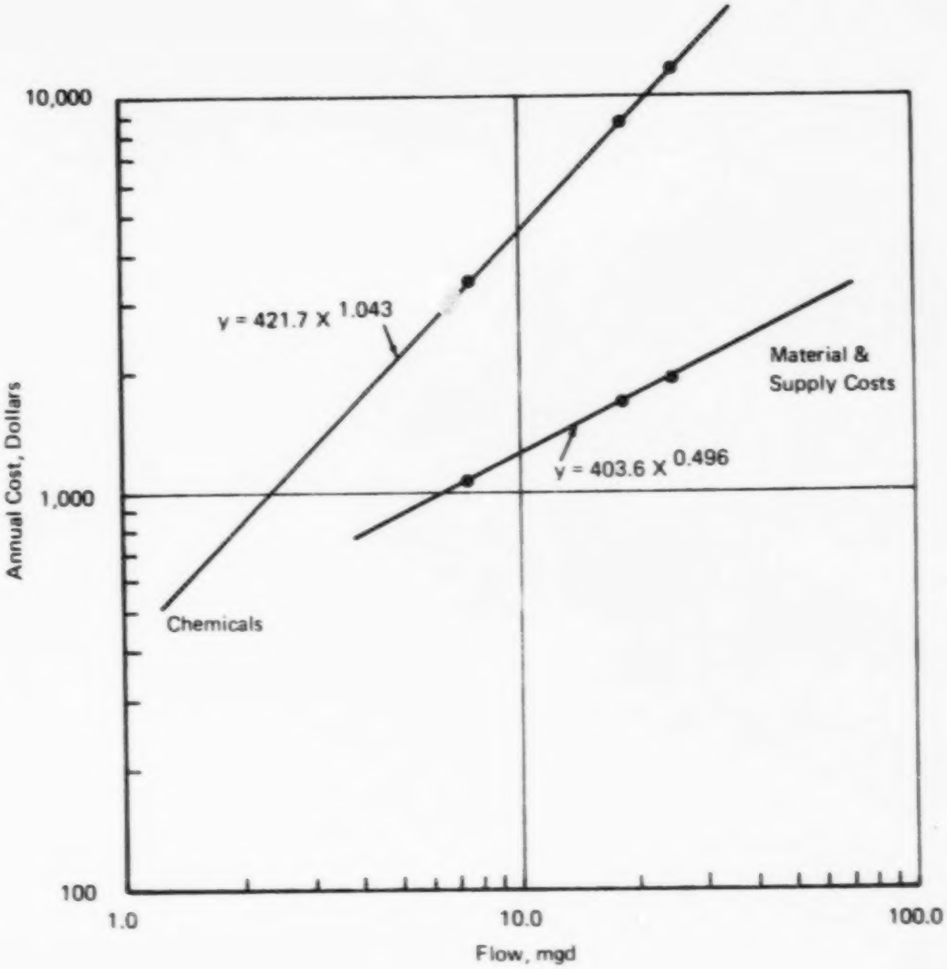


FIGURE A-18 **AERATED STABILIZATION BASIN**
1. Material and Supply Costs
2. Chemical Costs

Specific chemical costs are associated with the aerated stabilization basin (Figure A-18) and the secondary clarifier (Figure A-17).

(4) Energy and Power Cost. Power costs are related, where appropriate, to the same sizing parameters used for construction costs. Costs were based upon: $0.015/kwh and 70% motor efficiency. Fuel costs were based on fuel oil at $1.00/million Btu and steam at $1.50/million Btu. Power costs are associated with the aerated stabilization basin for aeration equipment (Figure A-19).

(5) Landfill Costs. Two costs are considered for landfill operations: handling and burial. Handling charges were costed at $0.25/ft^3 of solids generated from incineration; burial costs were based on $15 per dry ton of solids.

(6) Other Contributions to Annual Costs. These are financing costs at 8% of capital investment, depreciation at 10% of capital investment (i.e., straight-line depreciation with a 10-year assumed life) and taxes and insurance at 1.5% of capital investment.

c. Cost Calculation – Worked Example

To illustrate the methodology described above, a worked example is shown in Table A-1. This calculation develops the costs for BPT treatment for a medium-sized woven fabric finishing mill (Category 4) with a production rate of 72,500 lb/day.

3. BEST AVAILABLE TREATMENT TECHNOLOGY (LEVEL II)

Costs for meeting BAT guidelines have been calculated on the assumption that the necessary further reductions in BOD, COD, suspended solids, and the fecal coliform guideline can be met by the use of lime treatment, multimedia filtration, and final chlorination. This technology is *in addition* to the extended biological treatment required to achieve BPT guidelines (Figure A-20).

The methodology was developed in the same way as for BPT guidelines using the following *additional* cost elements.

a. Capital Cost Elements

(1) Lime Treatment. It is assumed that COD, particularly disperse dyes, can be reduced by precipitation with lime. A diagram of the necessary process steps is given in Figure A-21. Capital costs of this step are obtained from Figure A-22.

(2) Multimedia Filtration. This step is used for reduction of total suspended solids as a final polishing step (Figure A-23).

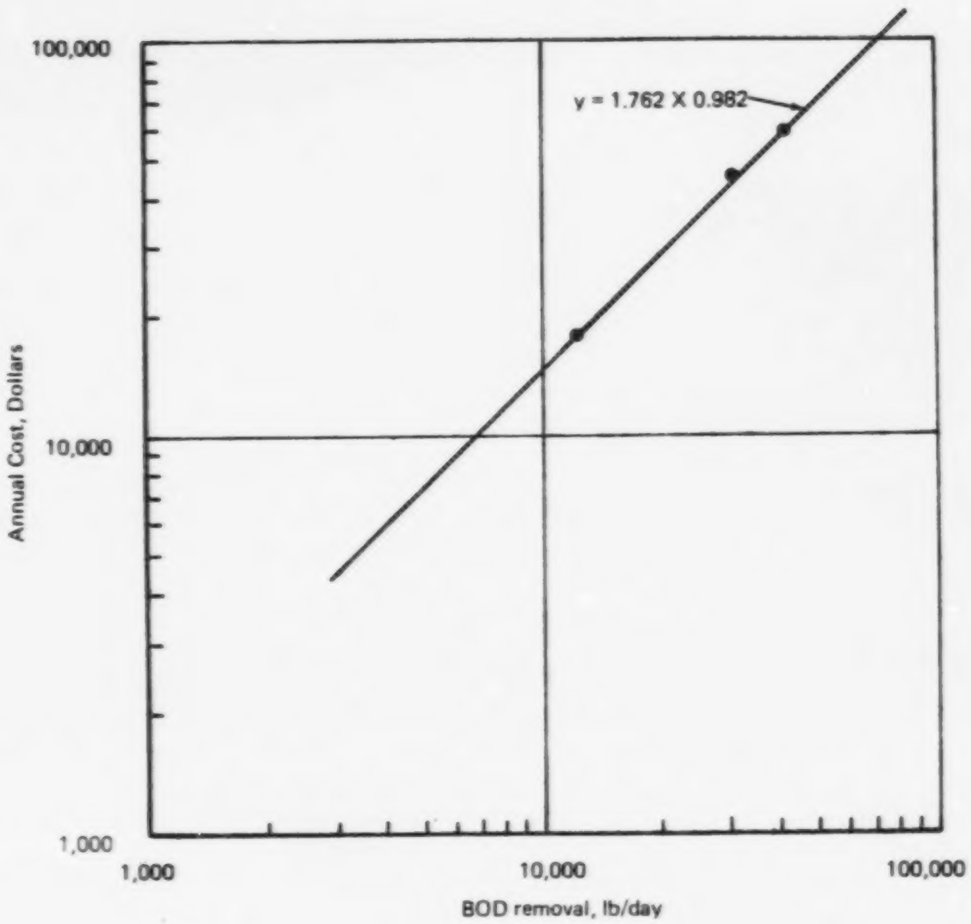


FIGURE A-19 **AERATION EQUIPMENT**
ANNUAL POWER COSTS
Aerated Stabilization Basin

TABLE A-1

COST OF WASTE TREATMENT TO ACHIEVE BEST PRACTICABLE TECHNOLOGY

Basis

Category 4 – Woven Fabric Finishing

Production	72,500 lb/day
Water Use	18 gal/lb product
Treatment Plant Size	1.3 mgd
BOD Removal	1900 lb/day

Capital Investment

Element	**Refer to Figure**	**$000's**
Primary Screening	A-7	18.8
Aeration Stabilization Basin	A-9	43.0
Aeration Equipment	A-10	38.4
Clarifier	A-8	82.2
3-day Lagoon	A-11	22.5
Subtotal		204.9
Yardwork at 15%		30.7
Subtotal		235.6
Engineering		42.4
Total		278.0

Annual Costs

Labor (Operation and Maintenance)	16.4
Materials and Supplies	5.2
Power and Fuel	2.9
Financing Costs (8% of capital investment)	22.2
Depreciation (10% of capital investment)	27.8
Taxes and Insurance (1.5% of capital investment)	4.2
Total	78.7

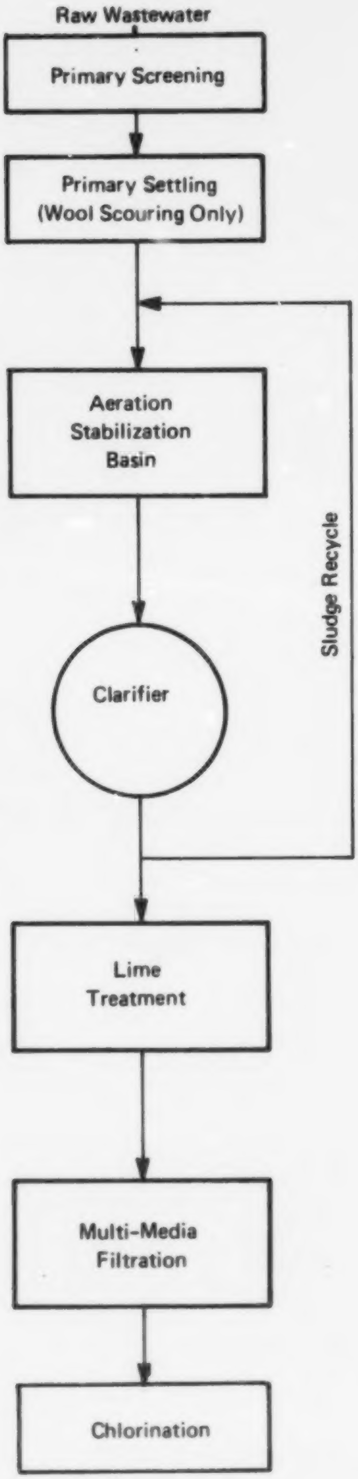

Raw Wastewater
Primary Screening
Primary Settling (Wool Scouring Only)
Aeration Stabilization Basin
Sludge Recycle
Clarifier
Lime Treatment
Multi-Media Filtration
Chlorination

FIGURE A-20 SCHEMATIC FLOW DIAGRAM OF PROCESS STEPS AND COST CENTERS FOR LEVEL II TREATMENT

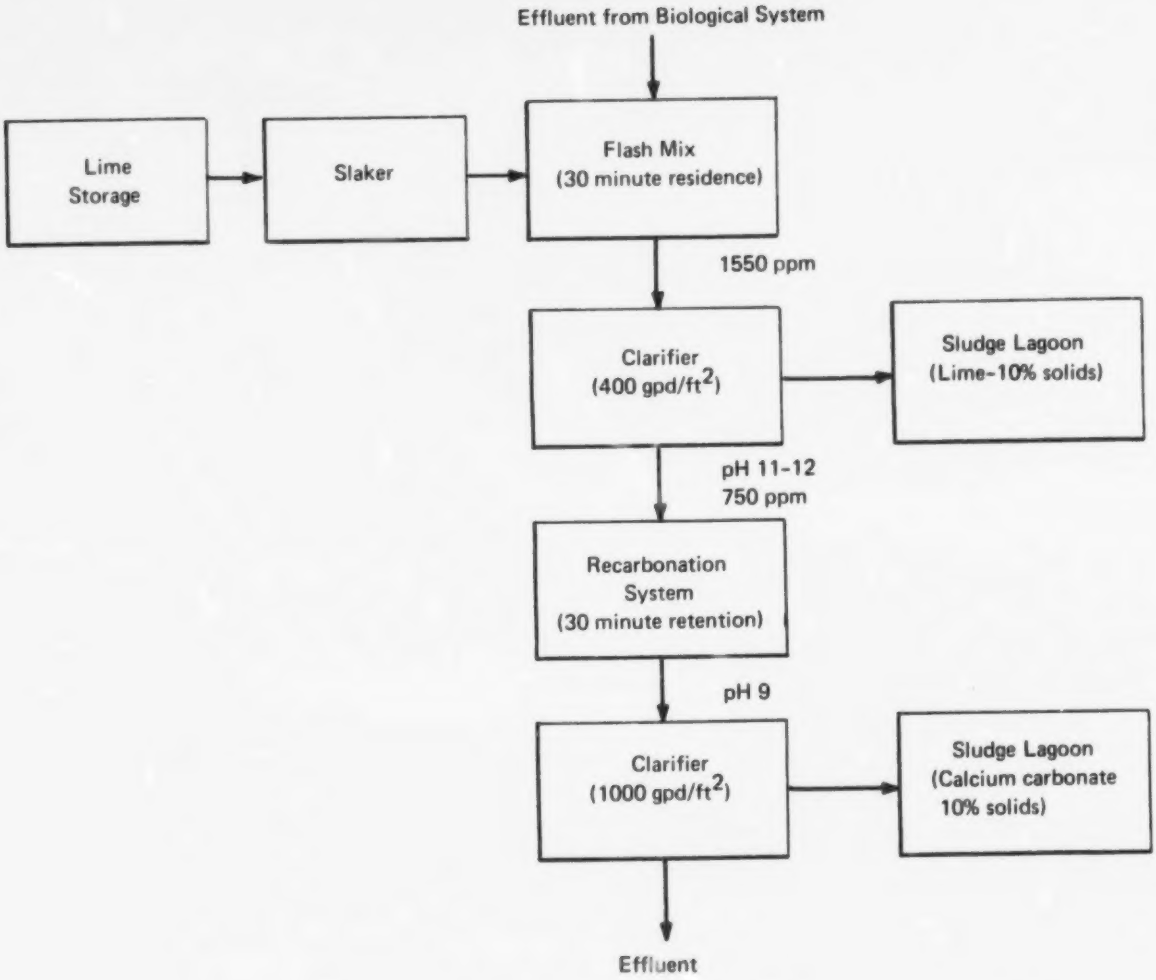

Effluent from Biological System
Lime Storage
Slaker
Flash Mix (30 minute residence)
1550 ppm
Clarifier (400 gpd/ft2)
Sludge Lagoon (Lime-10% solids)
pH 11-12
750 ppm
Recarbonation System (30 minute retention)
pH 9
Clarifier (1000 gpd/ft2)
Sludge Lagoon (Calcium carbonate 10% solids)
Effluent

FIGURE A-21 PROCESS STEPS FOR LIME TREATMENT

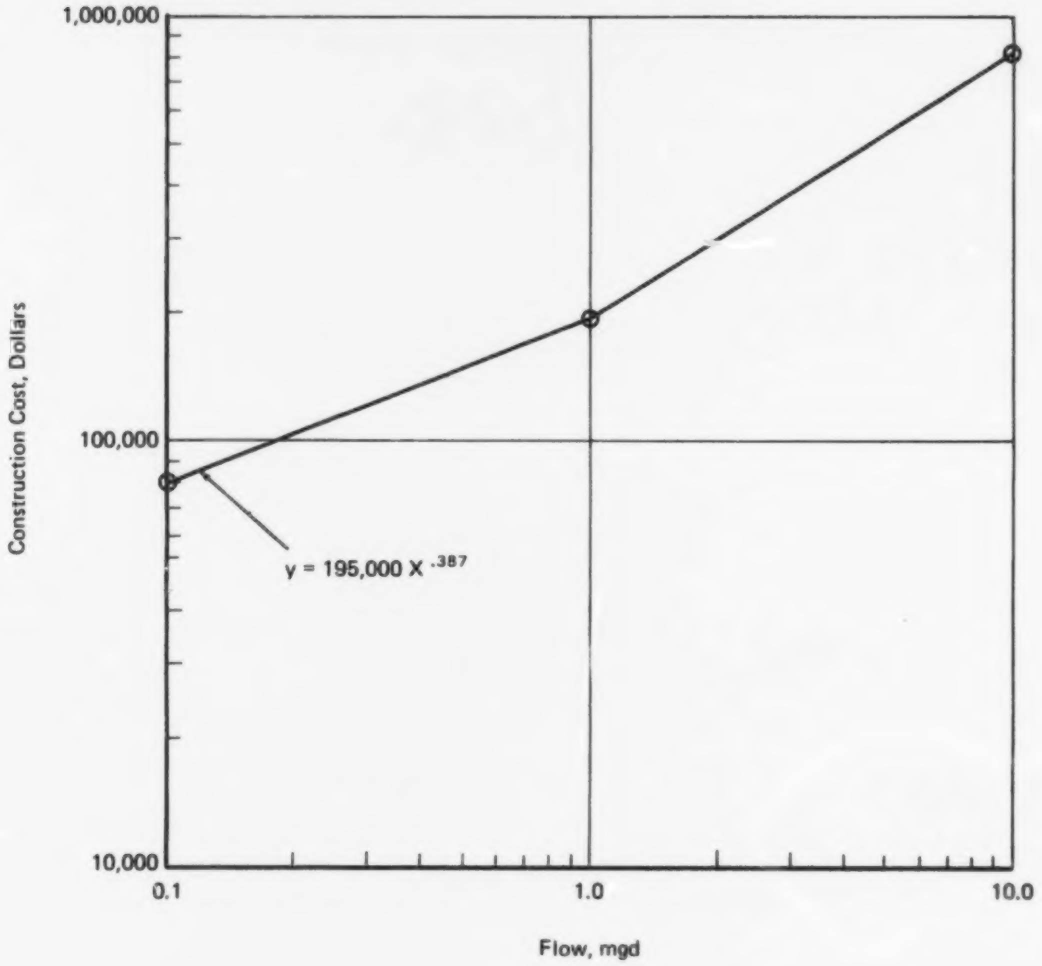


FIGURE A-22 LIME TREATMENT

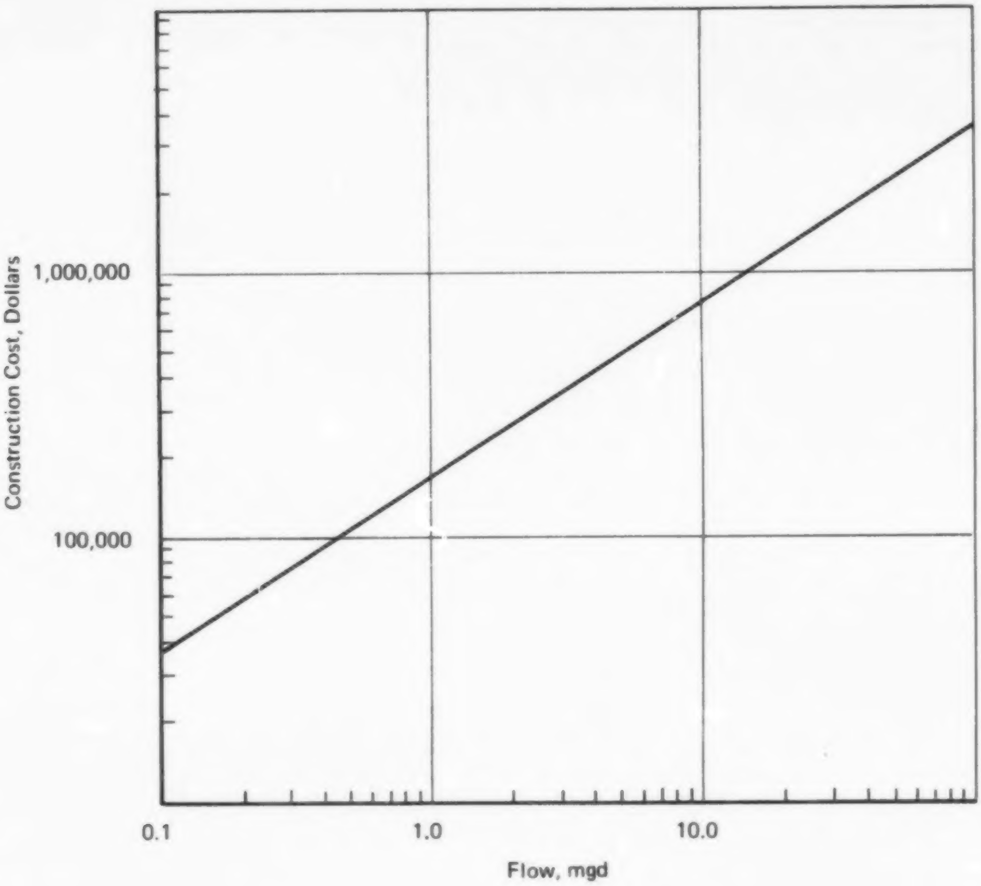


FIGURE A-23 MULTI-MEDIA FILTRATION – CONSTRUCTION COSTS

(3) Chlorination. Chlorine is added to waste water during the treatment process as an aid to treatment and for disinfection prior to discharge of effluent to a receiving stream. The cost of chlorine varies with the quantity used and the distance between the point of manufacture and the point of use. Our cost estimates are based upon the purchase of chlorine in 150- or 2000-lb cylinders. About $0.15 per pound might be a maximum at a small plant distant from the manufacture point and $0.03 per pound a minimum. The construction costs include the chlorination equipment, chlorine feed building, chlorine storage building, handling equipment, and scales. The contact basin is sized for 30-minute detention (Figure A-24).

(b) Annual Cost Elements

(1) Operation and Maintenance Labor. Includes labor for lime treatment (estimated as [Figure A-14 and Figure A-25] multiplied by 2) for multimedia filtration (Figure A-26) and chlorination (Figure A-25).

(2) Materials and Supplies. Includes materials and supplies for lime treatment, lime at $0.163/1000 gallons, other materials and supplies (Figure A-17 and Figure A-27) multiplied by 2. Materials and supplies for multimedia filtration from Figure A-28 and for chlorination from Figure A-27.

(3) Power and Fuel. Fuel is required for lime treatment in the recarbonation step at a cost of $0.32/1000 gallons.

4. PRETREATMENT COSTS

Pretreatment is required to remove the so-called "incompatible" constituents before an industrial effluent can be discharged to a municipal system. Examples of incompatible components are COD, chromium, phenols, and sulfide. In general, textile wastes are highly treatable in municipal treatment systems. It is assumed that these plants with wastes that are difficult to treat can eliminate incompatible components by the use of alternative chemicals within the textile mill.

In calculating the costs it has been assumed that only simple pretreatment will be required, based on primary screening followed by an 8-hour retention basin for equilization. Figures A-7, A-29, A-30, and A-31 were used to develop the pretreatment costs.

The cost of treating the waste water municipally can be added to the pretreatment costs. A cost schedule has been developed for treatment of waste water in a municipal system within two size ranges. On a cents/1000 gallons basis, this additional cost would be $0.39 for a 10- to 20-mgd plant and $0.63 for a 1- to 3-mgd plant. We have used a figure of $0.40/1000 gal in calculating *total* annual treatment costs (including pretreatment) for discharge to a municipal treatment plant.

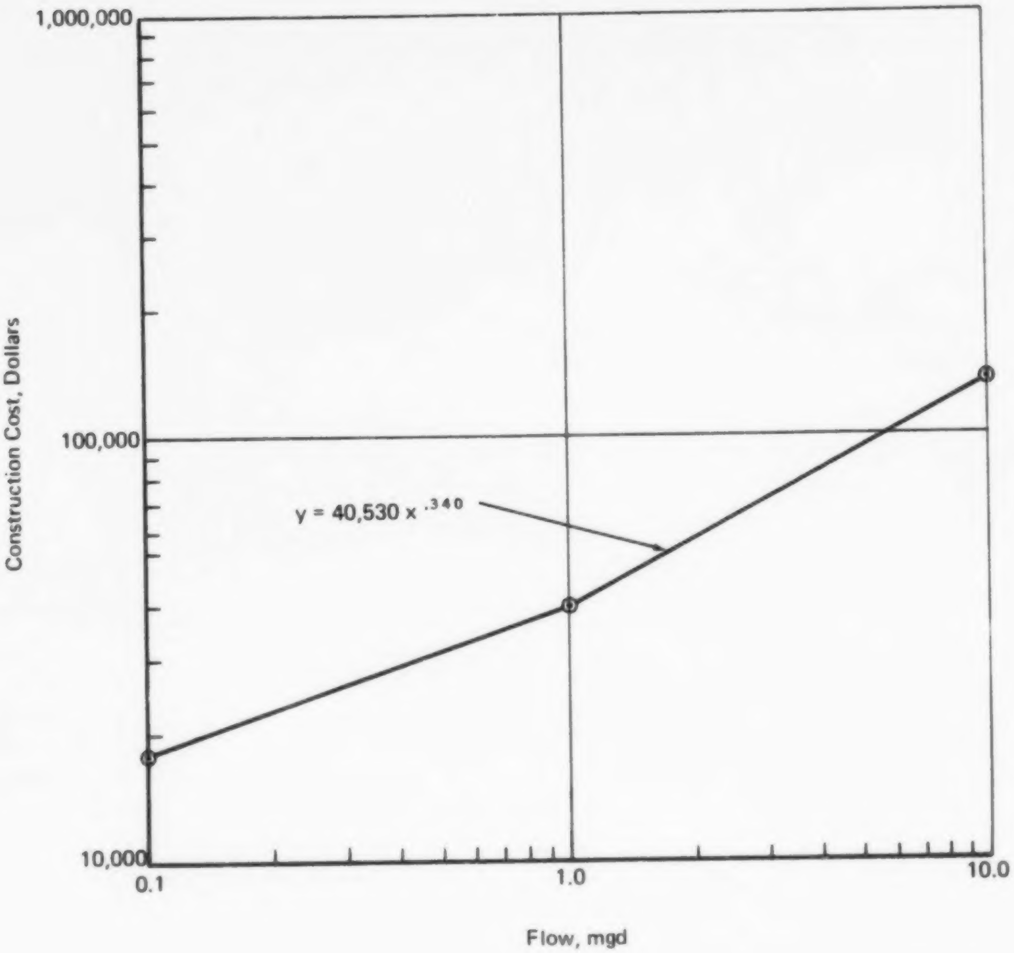


FIGURE A-24 CHLORINATION – CONSTRUCTION COSTS

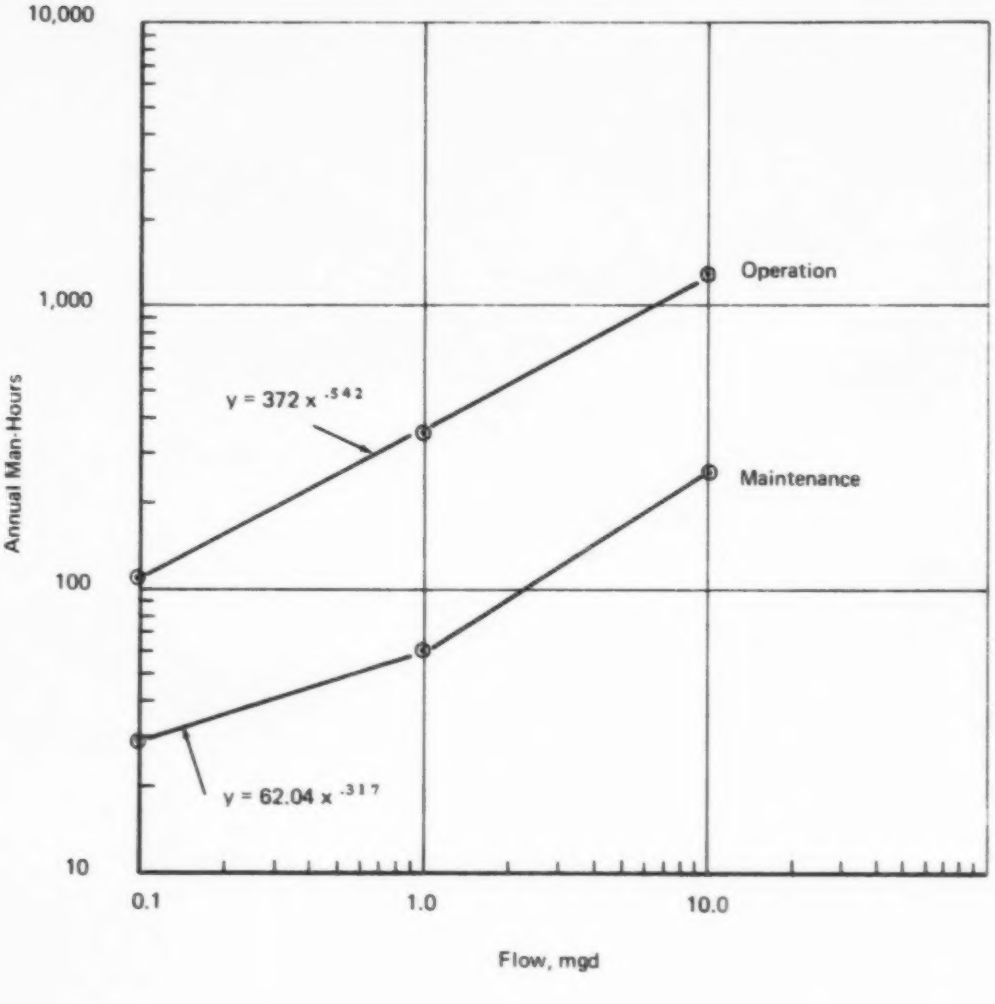


FIGURE A-25 CHLORINATION – ANNUAL OPERATION AND MAINTENANCE LABOR

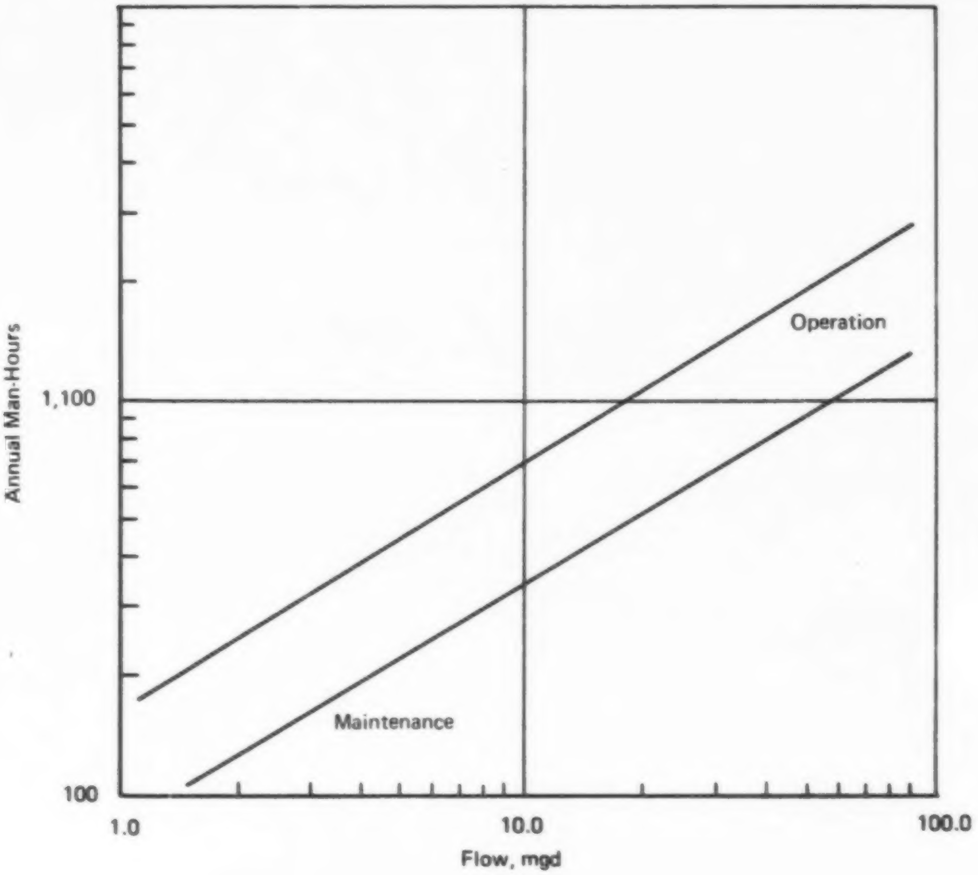


FIGURE A-26 MULTI-MEDIA FILTRATION – ANNUAL OPERATION AND MAINTENANCE LABOR

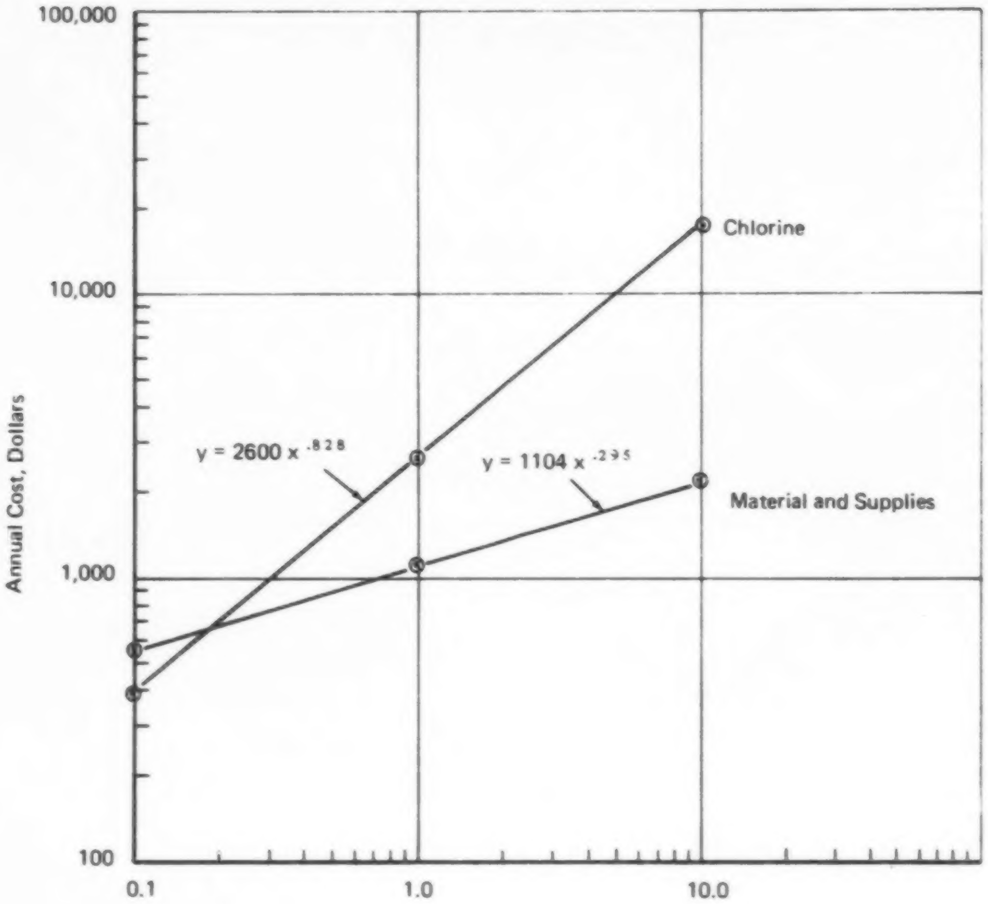


FIGURE A-27 CHLORINATION – CHEMICALS AND MATERIAL AND SUPPLIES

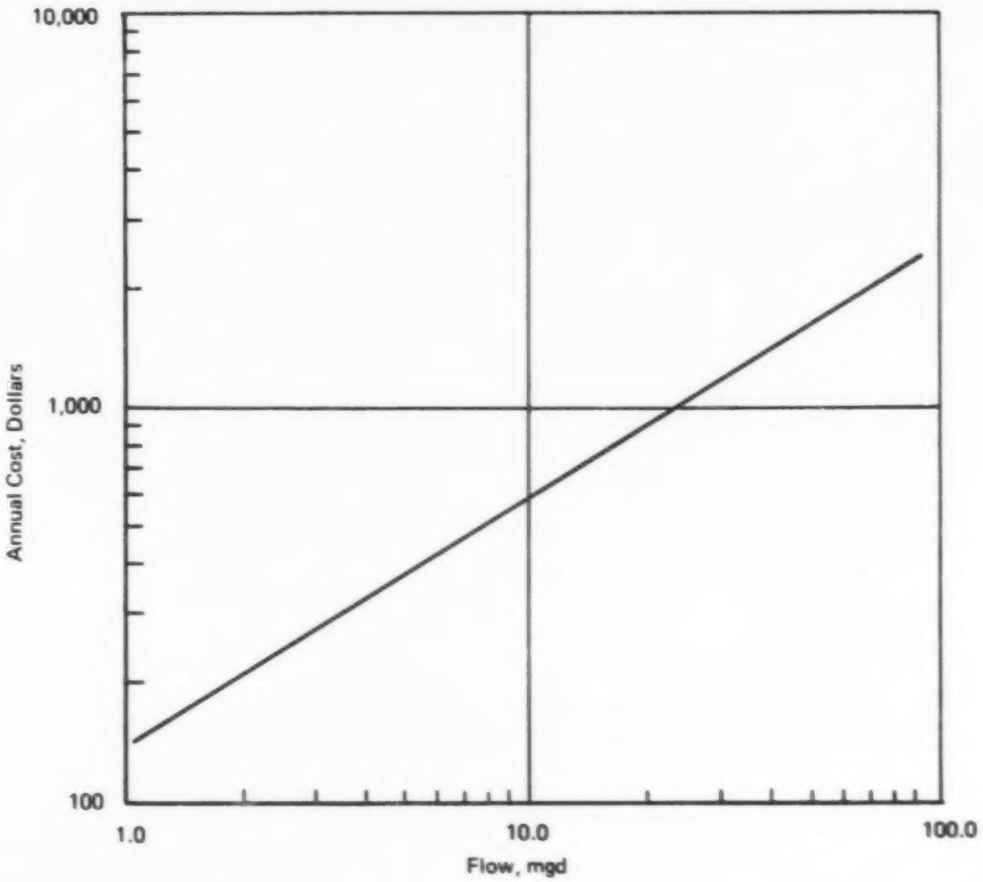


FIGURE A-28 MULTI-MEDIA FILTRATION – ANNUAL MATERIAL AND SUPPLY COSTS

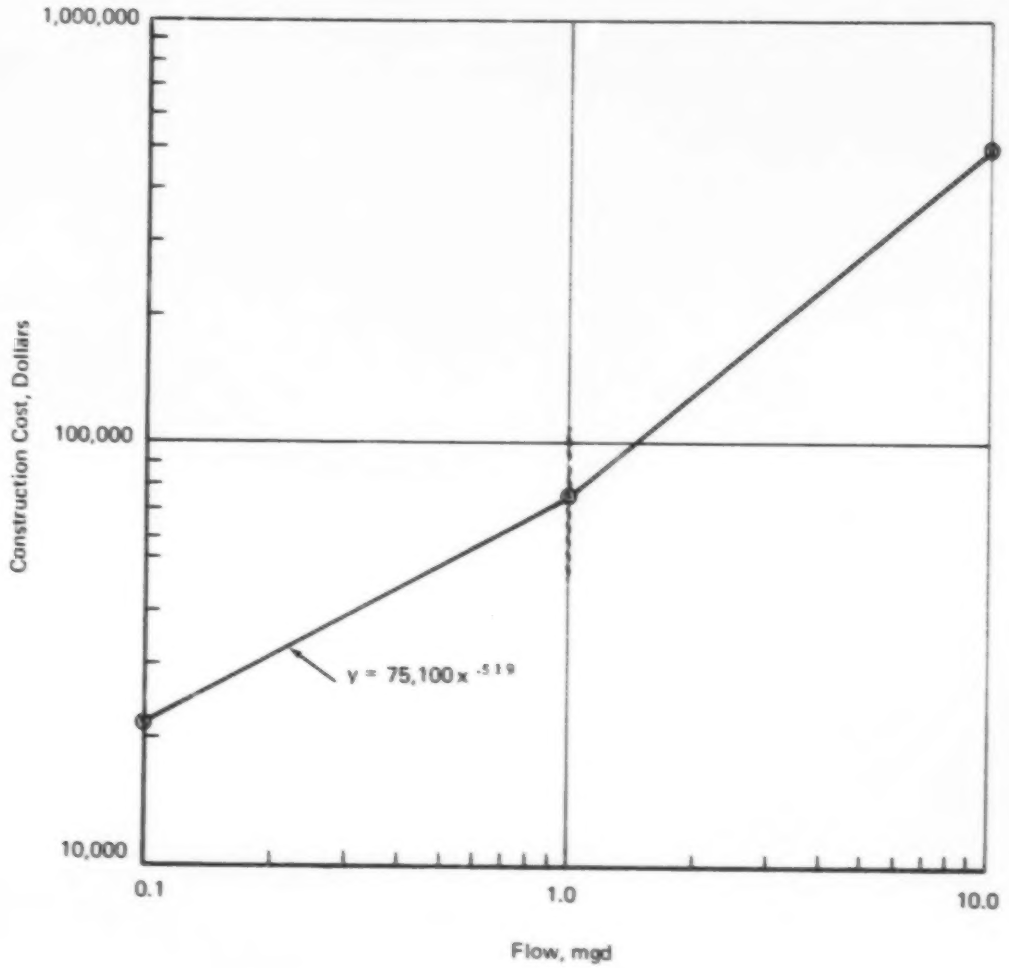


FIGURE A-29 EQUALIZATION (8 HOURS) – CONSTRUCTION COST

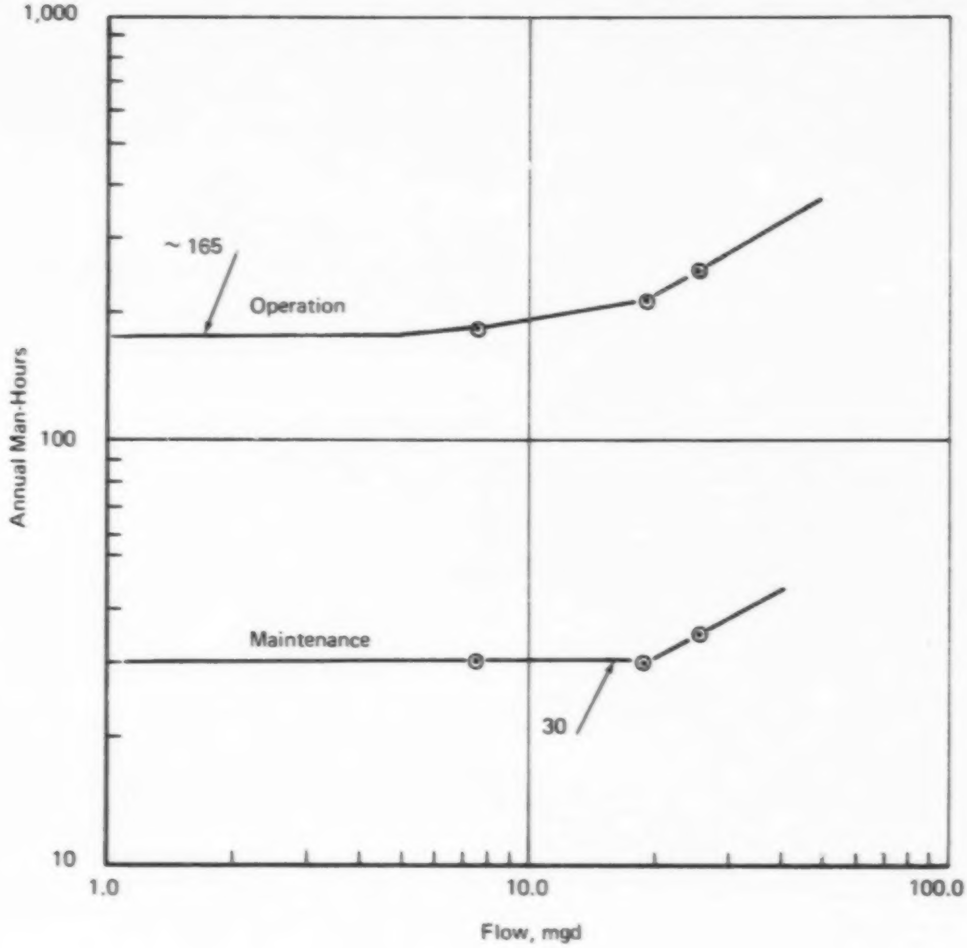


FIGURE A-30   ANNUAL OPERATION AND MAINTENANCE LABOR – EQUALIZATION

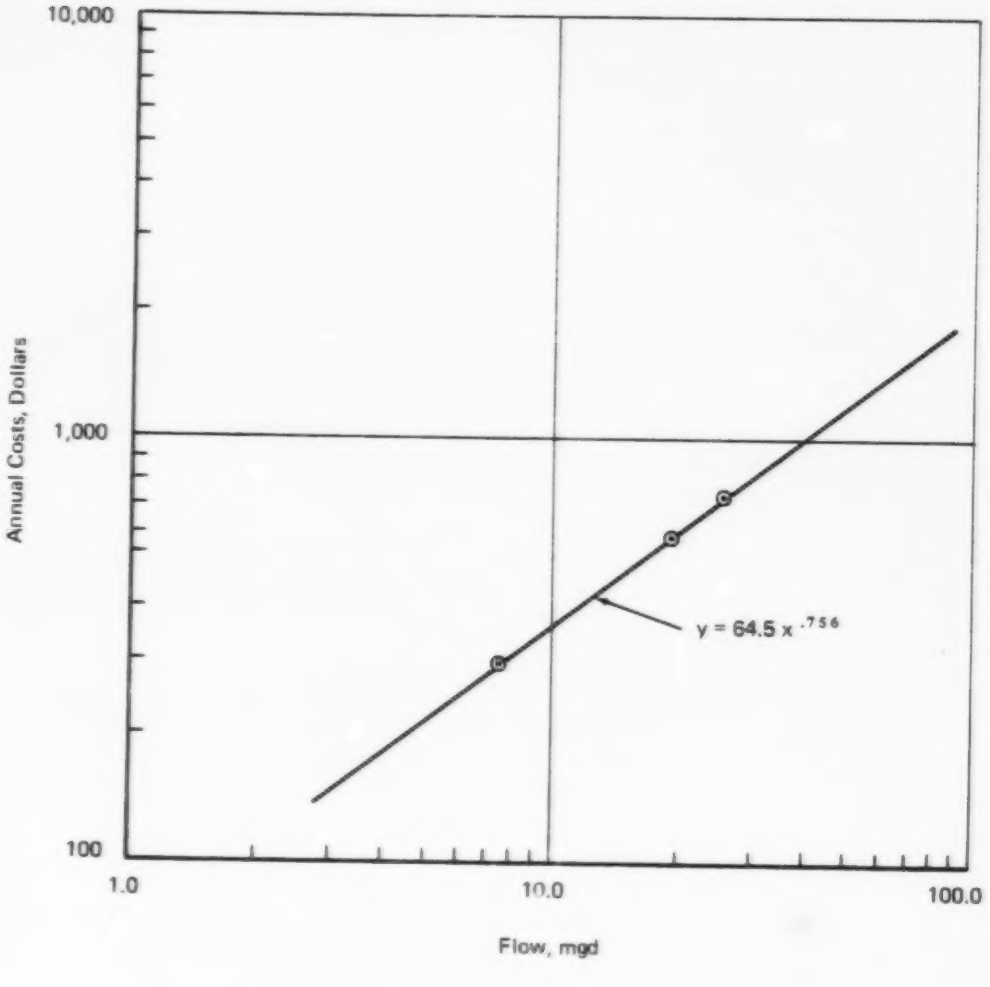


FIGURE A-31 ANNUAL MATERIAL AND SUPPLY COSTS – EQUALIZATION

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